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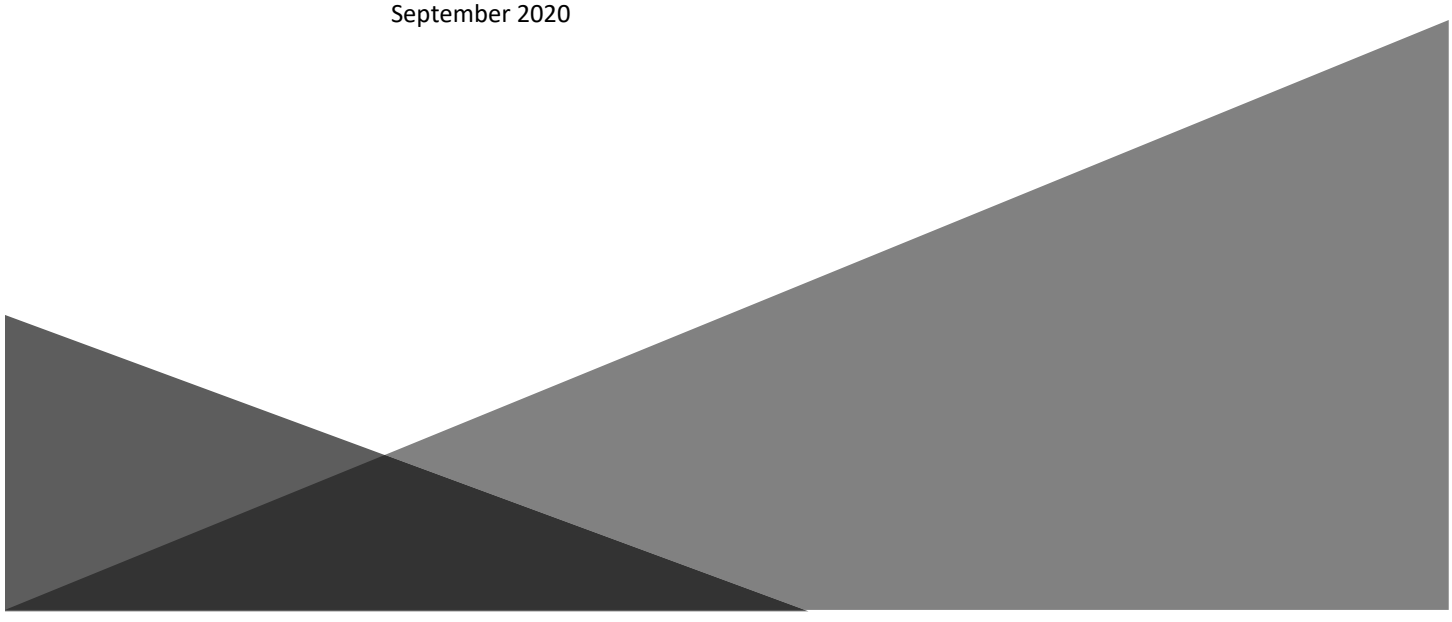
HYDROGEOLOGICAL CONCEPTUAL SITE MODEL, REV. 2
FORT CALHOUN STATION
BLAIR, NEBRASKA

by
Haley & Aldrich, Inc.
Portland, Maine

for
Energy*Solutions*
Blair, Nebraska

File No. 129760
September 2020



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03 September 2020
File No. 129760-006

Mr. Scott Zoller
Energy*Solutions*
9610 Power Lane
Blair, Nebraska 68008

Subject: Hydrogeological Conceptual Site Model, Rev. 1
Fort Calhoun Station
9610 Power Lane
Blair, Nebraska

Dear Mr. Zoller:

Haley & Aldrich is pleased to submit this Revised Hydrogeological Conceptual Site Model (CSM) for the Fort Calhoun Station (FCS). This report summarizes the physical setting of FCS with respect to groundwater flow regimes and aquifer properties that may then be used to support the development of Derived Concentration Guideline Levels (DCGLs).

This work has been completed consistent with industry standards as well as requirements under the Nebraska Department of Natural Resources (DNR) and the Nuclear Regulatory Commission (NRC). If you have any questions or would like to discuss our findings, please do not hesitate to call Nadia Glucksberg at 207-482-4623 at your convenience.

Sincerely yours,
HALEY & ALDRICH, INC.

Miles van Noordennen
Senior Technical Specialist

Nadia Glucksberg
Program Manager | Hydrogeologist

Enclosures

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SIGNATURE PAGE FOR

HYDROGEOLOGICAL CONCEPTUAL SITE MODEL, REV. 1
FORT CALHOUN STATION
BLAIR, NEBRASKA

PREPARED FOR
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Acronyms

ALARA	As Low As Reasonably Achievable
AOI	Area of Interest
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cm/sec	centimeters per second
COC	contaminant of concern
CSM	Conceptual Site Model
DCGL	Derived Concentration Guideline Level
EPA	United States Environmental Protection Agency
FCS	Fort Calhoun Station
ft/ft	feet per feet
ft/yr	feet per year
Haley & Aldrich	Haley & Aldrich, Inc.
HSA	Historical Site Assessment
MCL	Maximum Contaminant Level
mr/yr	millirem per year
MSL	mean sea level
MW	megawatt
NDNR	Nebraska Department of Natural Resources
NRC	Nuclear Regulatory Commission
OPPD	Omaha Public Power District
PCB	polychlorinated biphenyl
PWR	pressurized water reactor
REMP	Radiological Effluent Monitoring Program
TEDE	Total Effective Dose Equivalent
USACE	United States Army Corps of Engineers

1. Introduction

Haley & Aldrich, Inc. (Haley & Aldrich) has been contracted by Energy*Solutions* to develop a Hydrogeological Conceptual Site Model (CSM) of the Fort Calhoun Station (FCS) located in Blair, Nebraska (Figure 1-1). The purpose of this Hydrogeological CSM is to better understand the hydrogeological setting in support of the Site's decommissioning and ongoing Radiological Effluent Monitoring Program (REMP).

This Hydrogeological CSM has been developed to better understand groundwater flow regimes to support the calculations of Derived Concentration Guideline Levels (DCGLs) as part of license termination.

To develop this Hydrogeological CSM, Haley & Aldrich performed the following:

- Completed a file review of existing environmental documents;
- Completed a site walk down;
- Reviewed previously completed geotechnical investigations;
- Collected samples for geotechnical parameters; and
- Conducted hydraulic conductivity testing.

Data will also be used to support License Termination activities by providing input parameters for RESRAD modeling and by assisting with the development of site DCGLs. These activities will be completed under a separate cover.

1.1 BACKGROUND

FCS was a 484-megawatt (MW) pressurized water reactor (PWR) that is owned by Omaha Public Power District (OPPD), with Energy*Solutions* currently holding the Nuclear Regulatory Commission (NRC) license. The site is 660.46 acres, approximately 19.4 miles north of Omaha, Nebraska, located on the west bank of the Missouri River at river mile 646.0. About 85 percent of the site area is on relatively level ground located in the alluvial plain of the river. On the western section of the site, the ground rises sharply about 60 feet to a level area which is bounded on the west by Highway 75 (Figure 1-2).

1.2 REGULATORY SETTING

The NRC is the primary regulatory stakeholder for license termination. However, it is also recognized that the Nebraska Department of Natural Resources (NDNR) and the United States Environmental Protection Agency (EPA) may also have jurisdiction over the groundwater, soil, and surface waters if they have been impacted by historical site operations.

Below is a brief description of the regulatory requirements for each agency with respect to current and potential future radiological authority.

- **NRC Requirements:** The NRC requires a cleanup goal of 25 millirem per year (mr/yr) Total Effective Dose Equivalent (TEDE) plus As Low As Reasonably Achievable (ALARA). This means that the total radiation dose via all active exposure pathways (e.g., direct, inhalation, and ingestion) cannot exceed the published regulatory criteria without written approval. However, realistic property uses and associated future scenarios can be used to calculate site-specific

DCGLs that correspond to the 25 mr/yr dose limit. For groundwater, it is critical to first understand if there have been any impacts to the aquifer; and if so, to define the extent of the impacts as well as understand the fate and transport of radionuclides in groundwater. This knowledge can then be used to determine the contribution of groundwater dose to the DCGLs.

- **NDNR Requirements:** The State of Nebraska requires that sites meet the 25 mr/yr TEDE plus ALARA for all pathways at license termination. In addition, the NDNR establishes investigation and remediation requirements for hazardous substances, which at a minimum include chemical parameters such as lead, polychlorinated biphenyls (PCBs), and petroleum in soil, groundwater, surface water, and sediments. The NDNR has classified groundwater at the site as Class GB, which is assigned to waters that are currently being used as or have the potential to be used as public or private drinking water supply.

- **EPA Requirements:** The EPA will not regulate radionuclides in the environment at an NRC-licensed site until the license has been terminated. As noted above, the NRC will likely require final DCGLs to correspond to a dose of 25 mr/yr TEDE plus ALARA. However, if groundwater concentrations exceed the EPA drinking water standards (e.g., Maximum Contaminant Levels [MCLs]) at the time of license termination, then the NRC and EPA will hold a consultation. If EPA does not approve of the groundwater quality to be left at the time of license termination, they may invoke regulatory authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to require further investigation and/or remediation.

2. Physical Setting

This section provides an overview of the physical setting of the area, with a focus on the plant itself, and specifically how the physical setting impacts groundwater flow directions and hydrogeological properties.

The site is located at latitude 41 degrees, 31 minutes, and 14 seconds north and longitude 96 degrees, 4 minutes, and 39 seconds west, in Blair, Nebraska, with the area land predominantly being used for agriculture.

2.1 TOPOGRAPHY

FCS is situated within parts of Section 20 and 21, Township 18 North, Range 12 East of Washington County, Nebraska in the Modale quadrangle. The site is part of the Missouri River bottomland, which is a nearly level plain about 15 miles wide at Blair, 8 miles wide at the site, and narrowing to 3 miles wide in the vicinity of Omaha-Council Bluffs. The elevation of this plain averages about 1,000 feet above mean sea level (MSL) at the site.

The surface of the land, starting from the Missouri River at about elevation 997 feet above MSL, falls to an old channel of the river before rising again to approximately 1,004 feet above MSL. Beyond this point, the land then gradually falls off to about 1,000 feet, rises again to approximately 1,020 feet, and then rises approximately 60 feet to a higher plateau at elevation 1,080 feet above MSL.

The Missouri River, which flows generally north to south, forms the northeast to southeast site boundary. This part of the river is referred to by the United States Army Corps of Engineers (USACE) as the Blair Bend. The river limits are under control of the USACE, who have established a structure azimuth line which acts as another site boundary.

The site drainage development program provides proper drainage of the plant site and upstream properties. This system controls runoff of local precipitation; drainage empties into the Missouri River north of the plant. The topography of the site is shown on Figure 2-1.

2.2 GEOLOGY

The soils below the FCS include thick beds of limestone, dolomite, shale, and sandstone with some thin layers of coal beds. The deeper formations were deposited in marine depositions with the shallow soils from the lateral migration of the paleo river channel. The major tectonic features of the mid-continent region began to develop late in the Paleozoic Era, along with most of the important structural features of the Nebraska Iowa Missouri River Valley area. However, there is no record of movement of the fault in historical times, nor is there any indication of activity in recent geologic time.

At the beginning of the Pleistocene period, the Missouri River Valley and its main tributaries were established in their approximate present positions. Subsequently under successive glacial movements, the valleys were filled and reopened several times. During this period, the Peorian loess was deposited on the terraces and adjacent uplands. It is probable that only the upper part of the alluvium in the Missouri River Valley is actually of recent age and that deeper deposits are mostly of Pleistocene age.

Unconsolidated sediments at the plant site generally range from 65 to 75 feet in thickness. The soils are typically interstratified and cross-bedded. These soils may be grouped generally into two units:

1. An upper fine-grained sandy clay with silt, ranging from 20 to 50 feet in thickness.

2. An underlying fine to coarse sand with some gravel, extending down to the relatively flat-lying carbonate bedrock surface at a depth of approximately 65 to 75 feet below ground surface (bgs).

The upper units represent former river deposits and are not likely continuous, but rather have preferential channels formed by paleo-oxbow deposits. Pennsylvanian-aged limestone and shale (bedrock) of the Kansas City Formation are encountered below the overburden soils. The bedrock below the site consists of various types of limestone formations.

2.3 HYDROGEOLOGY

Groundwater beneath the site is first encountered at depths ranging from approximately 15 to 20 feet bgs and the water table aquifer is in hydraulic communication with the adjacent Missouri River. Groundwater flow directions have been reported to be both toward the Missouri River (northeasterly) and away from the Missouri River (south-southwesterly) depending on the River's stage. Shallow flow directions toward the river represent times when the river levels are at normal or low stages. Shallow flow directions away from the river are likely to occur during times of high river stage (i.e. at flood or near flood stage), causing bank storage effects.

2.4 SURFACE WATER

The plant is bounded on the northeast and southeast by a portion of Blair Bend of the Missouri River. The USACE maintains river structures to prevent further meandering of the channel within the alluvial flood plain; the structures take the form of pile dikes and bank revetments. Fish Creek is an intermittent drainage system that runs along the [plant] north boundary of the Protected Area. This stream discharges into a larger wetland, before flowing into the Missouri River as shown on Figure 2-2.

There are six dams upstream of the site that control river flow. There are no dams, locks, or similar structures on the Missouri River downstream of the site. The site has been flooded several times with the most recent occurring in 2019, where the river overflowed its banks several times throughout the year. A wall is currently being constructed surrounding the plant site to act as a dam/berm to prevent future flooding events during decommissioning activities.

3. Current Site Conditions

The Hydrogeological CSM not only describes the history and hydrogeological setting of the site, but it also describes areas where contaminants of concern (COCs) were used or stored and thereby could potentially be released to the environment. These may be systems, storage tanks, or work practices that could have led to the potential release of radiological constituents to the environment. Each of these Areas of Interest (AOIs) is being evaluated as part of decommissioning with respect to radiological contamination and potential impacts to groundwater quality.

It should be noted that although this Hydrogeological CSM is focused on groundwater characterization, potential or known releases to soils can also migrate through the vadose zone and reach the water table. Generally isolated soils are those below impermeable caps such as building foundations. Contaminants in these soils are less likely to migrate in the subsurface as there is no mechanism for rainwater to percolate through, providing the necessary transport mechanism. However, it should also be noted that radionuclides that are present in isolated soils or beneath impermeable caps must still be characterized (and potentially remediated) to reach NRC License Termination.

3.1 RADIOLOGICAL AREAS OF INTEREST

The most prevalent radionuclides associated with nuclear power stations are cobalt (Co-60), cesium (Cs-137), strontium (Sr-90), and tritium (H-3). Although there is the potential for other hard-to-detect radionuclides to be released, they would typically be co-located with the four isotopes listed above. Therefore, for the purpose of this Hydrogeologic CSM, these four radionuclides are the primary radiological COCs that are considered for potential releases to soils and groundwater.

Based on the Historical Site Assessment (HSA) completed previously (TSSD, 2016), there are several structures identified where site impacts could have released radiological contamination to groundwater. They include:

- Containment Structure
- Turbine Building
- Auxiliary Building
- Radwaste Processing Building
- Sanitary Lagoons
- Landfill

Each structure or AOI is described further in the HSA as well as the subsequent Limited Site Radiological Characterization Survey Report completed in 2017 (TSSD, 2017). Evaluation of the REMP program with respect to well placement and sampling frequency is provided under separate cover.

3.2 CURRENT GROUNDWATER MONITORING NETWORK

There are currently 17 groundwater monitoring wells onsite at the FCS. Quarterly samples are collected from eight of the existing wells as part of the groundwater protection program. Samples are submitted for tritium. In addition, on an annual basis from seven wells, and quarterly from one well, samples are also submitted for gamma and hard-to-detect isotopes. Results have all been below background values or non-detect. Monitoring wells are shown on Figure 3-1. Well construction details are included in Table 3-1.

4. Field Activities

To better understand the geological and hydrogeological setting at the FCS, a field investigation was completed in June 2020 to augment existing data. Direct push methods were used to log soils throughout the site, collect geotechnical samples, and complete hydrological testing in the unsaturated zone. In addition, existing groundwater monitoring wells were used to collect groundwater information and complete hydrological testing in the saturated zone. These activities are discussed in detail below.

4.1 GEOTECHNICAL SOIL SAMPLING

To better understand the site soils, and to collect analytical geotechnical samples to support the RESRAD modeling task, direct push methods were utilized onsite to log and collect soils. Drilling was completed at 28 locations throughout the site, from both inside and outside of the Protected Area. At 21 of the locations, soils were drilled to a total depth of 10 feet bgs. Soils were logged continuously to document conditions and characteristics. At the other seven locations, soils were drilled to a total depth of 20 feet bgs. In addition to logging those soils, samples were collected and submitted for geotechnical analyses. Samples were collected from both the unsaturated and saturated zones to provide the appropriate data for RESRAD input parameters. Field forms are included in Appendix A. Geotechnical results to support the RESRAD modeling are provided under separate cover.

4.2 HYDROLOGICAL CHARACTERIZATION

To better understand the site hydrological setting, including groundwater flow and other information, data was collected from the existing groundwater monitoring well network onsite. A synoptic water level round was conducted, measuring the depth to groundwater at each of the 17 wells on-site. Following the water level round, limited or modified pumping tests and hydraulic conductivity (i.e. 'slug') tests were conducted at seven of the monitoring wells to collect further information on the hydrological characteristics of the aquifers below the site. Results from those investigations are provided in Section 5 below.

4.3 VADOSE ZONE CONDUCTIVITY TESTING

In addition to the geotechnical soil sampling and the hydrological testing discussed above, falling head tests were performed at seven of the direct push locations to evaluate the infiltration rate and be able to calculate the hydraulic conductivity of the vadose zone to provide additional input parameters for RESRAD modeling. Locations were drilled to five feet bgs, with the drill casing then pulled up approximately 1 foot, leaving an open borehole with soils exposed from approximately 4 – 5 feet bgs. The boreholes were then filled with potable water, with data being collected as the falling water level within the borehole was monitored. These results are discussed in Section 5 below.

5. Findings

Following the field investigation completed in June 2020, geotechnical and hydrological settings at the FCS are now better understood. With the data collected from both 2020 field activities and from previous investigations completed on-site, information to support the Hydrological CSM is presented below.

Based on the groundwater depth to water data, and corresponding groundwater elevation data, groundwater contours are consistent with historical data and are flowing towards the River. Water levels collected in June 2020 show that the groundwater elevations ranged from 993.51 to 995.54 feet.

It should be noted that the groundwater elevation is in hydraulic communication with the Missouri River. Based on the gauging stations both upriver and downriver, located approximately 25 miles from the plant in each direction, the historical river stage varies widely and is prone to flooding. The past 10 years of river state data from these stations is presented in Appendix C and shows an average steady gage height of 15 to 20 feet. Therefore, it may be assumed that the overall elevation of the groundwater or water table has also been consistent throughout this period.

Horizontal hydraulic gradients at the site are nearly flat with relatively slow groundwater velocity, with only a gentle slope toward the Missouri River. From elevation data collected in June 2020, the approximate average gradient in both the shallow and deeper system was 0.0008 feet/feet (ft/ft). Groundwater contours from June 2020 are presented in Figures 5-1 and 5-2. Groundwater elevation data is provided in Table 5-1 and hydraulic gradient data is presented in Appendix B. In addition to horizontal gradients, vertical gradients were calculated between shallow and deeper paired wells. Upward gradients were observed in well pairs MW-1A/B, MW-2A/B, and MW-4A/B ranging from 0.0004 to 0.059 ft/ft. Downward gradients were observed in well pairs MW-3A/B and MW-5A/B ranging from 0.0007 to 0.0039 ft/ft. These data are also provided in Appendix B.

Based on the classification of fine to medium sands and silts for the shallow soils, expected hydraulic conductivities for the shallow aquifer range from 10^{-5} centimeters per second (cm/sec) (or 10^{-1} feet per day) to 10^{-1} cm/sec (or 100 feet/day). Using the data collected from the modified pumping tests and/or slug tests completed in June 2020, calculated hydraulic conductivities ranged from 9.4×10^{-3} to 1.8×10^{-2} cm/sec. The measures values are within the range for these types of soils. A summary of these results is provided in Table 5-2. The complete analysis is provided in Appendix D.

Using the groundwater contours, horizontal hydraulic gradients, and hydraulic conductivity information discussed above, groundwater velocity data for the shallow and deeper aquifers were calculated. Groundwater velocity calculations are estimated from the June 2020 field measurements and contour plans, where the flow direction is towards the Missouri River. The resulting velocity calculations are therefore representative of this flow direction. Based upon the analysis, the groundwater velocities are very similar, with the shallow system ranging from 5.73 to 34.39 feet per year (ft/yr) and ranging from 5.86 to 35.16 ft/yr in the deeper system. These results are summarized in Appendix B.

In-situ falling head tests were completed at seven open borehole locations to determine the field coefficient of permeability (or hydraulic conductivity) of unsaturated soils (i.e. vadose zone). The field data collected from these tests was analyzed, with the recommended range for the RESRAD input parameters falling between 2×10^{-6} to 4×10^{-4} cm/sec. A summary of these results is provided in Table 5-3. The complete analysis is provided in Appendix E. It should be noted that at one location, the water

level remained unchanged. Therefore, these results only include the testing information from the other six locations.

Finally, to better understand the potential zone of influence for fill materials that may potentially be used to backfill the deeper basements (and to provide input parameters for the RESRAD Basement Fill Model), the estimated influence of different soil types for reasonable pumping rates were calculated. These calculations and corresponding rates are provided in Appendix F. The calculations indicate that with a pumping rate of 1.13 gallons per minute (gpm), a clean sand backfill material would result in a zone of influence for the residential farmer of approximately 2.7 feet (0.8 meters). If the backfill material is a silty sand, the zone of influence would increase to approximately 61 feet (18.6 meters). These calculations assume a pump rate of 1.13 gpm, and hydraulic conductivity values of $1x10^{-2}$ cm/sec (clean sand) and $1x10^{-3}$ cm/sec (silty sand). Soils from the onsite area identified as a potential backfill source have a hydraulic conductivity around $1x10^{-5}$ cm/sec and will not provide the desired flow with the available saturated thickness. As shown in Appendix F, fill soils with hydraulic conductivity values lower than $1x10^{-3}$ cm/sec will not produce the desired flow rate of 1.13 gpm. If the pump rate or hydraulic conductivity of the backfill material is different than the values assumed, the radius of influence may vary.

6. Conclusions

6.1 CONCLUSIONS

The following conclusions are based on the preliminary Hydrogeologic CSM:

- Geology generally consists of fine to medium sands and silts overlying fine to coarse sands and gravels. Bedrock is encountered approximately 65 to 75 feet bgs.

- The groundwater table is typically 15 to 20 feet bgs and the water table is in hydraulic communication with the Missouri River.

- Water generally flows in a northeasterly direction towards the river, although when the river stage is high, it is likely that groundwater flows in a south-southwesterly direction, temporarily away from the river.

- Vertical gradients for June 2020 (flow towards the Missouri River) range from approximately 0.0004 to 0.059 ft/ft. The average horizontal gradient is approximately 0.0008 ft/ft.

- Hydraulic conductivity measured in the field corresponds well to look up values and ranges from 9.4×10^{-3} to 1.8×10^{-2} cm/sec.

- Based on available data from June 2020, groundwater velocity towards the river ranges from approximately 5 to 35 feet per year.

References

1. TSSD, 2016. Historical Site Assessment Report, Fort Calhoun Nuclear Station, Omaha Public Power District, Blair, Nebraska. October 2016.

2. TSSD, 2017. Limited Radiological Characterization Survey Report, Fort Calhoun Nuclear Station, Omaha Public Power District, Blair, Nebraska. January 2017.

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TABLES

Table 3-1
Monitoring Well Construction Details
Fort Calhoun Station
Blair, Nebraska

Well ID	Well Depth (ft bgs)	Screen Length (ft)	Well Diameter (in)	Ground Surface Elevation (ft)	TOC Elevation (ft)
MW-1A	24	10	2	1004.6	1007.02
MW-1B	50	5	2	1004.5	1007.01
MW-2A	24	10	2	1004.9	1007.23
MW-2B	50	5	2	1004.9	1007.21
MW-3A	23	10	2	1004.7	1007.06
MW-3B	50	5	2	1005.2	1007.06
MW-4A	22	10	2	1003.4	1005.75
MW-4B	50	5	2	1003.3	1005.79
MW-5A	22	10	2	1003.5	1006.02
MW-5B	50	5	2	1003.5	1005.96
MW-6	22	10	2	1003.8	1006.21
MW-7	24	10	2	1002.9	1005.42
MW-9	26*	-	2	-	1007.08
MW-10	28*	-	2	-	1006.68
MW-11	25*	-	2	-	1003.89
MW-2	28*	-	2	-	1006.46
MW-3	28*	-	2	-	1006.33

Notes
* Well depths from TOC
- ft bgs: feet below ground surface
- in: inches
- TOC: top of casing

Table 5-1
Groundwater Elevation Data
Fort Calhoun Station
Blair, Nebraska

Well ID (PA)	DTW	TOC Elevation	GW Elevation
MW-1A	13.01	1007.02	994.01
MW-1B	13.01	1007.01	994.00
MW-2A	13.40	1007.23	993.83
MW-2B	13.40	1007.21	993.81
MW-3A	13.44	1007.06	993.62
MW-3B	13.42	1007.06	993.64
MW-4A	10.21	1005.75	995.54
MW-4B	12.05	1005.79	993.74
MW-5A	12.40	1006.02	993.62
MW-5B	12.22	1005.96	993.74
MW-6	12.70	1006.21	993.51
MW-7	11.69	1005.42	993.73
MW-9	13.14	1007.08	993.94
MW-10	12.75	1006.68	993.93
MW-11	10.00	1003.89	993.89
Well ID (Landfill)			
MW-2	12.74	1006.46	993.72
MW-3	12.74	1006.33	993.59

Notes
- Data collected 6/16/2020 - 6/17/2020
- All measured units in feet

DTW - depth to water
PA - Protected Area
TOC - top of casing

Table 5-2
Summary of Hydraulic Conductivity Data
Fort Calhoun Station
Blair, Nebraska

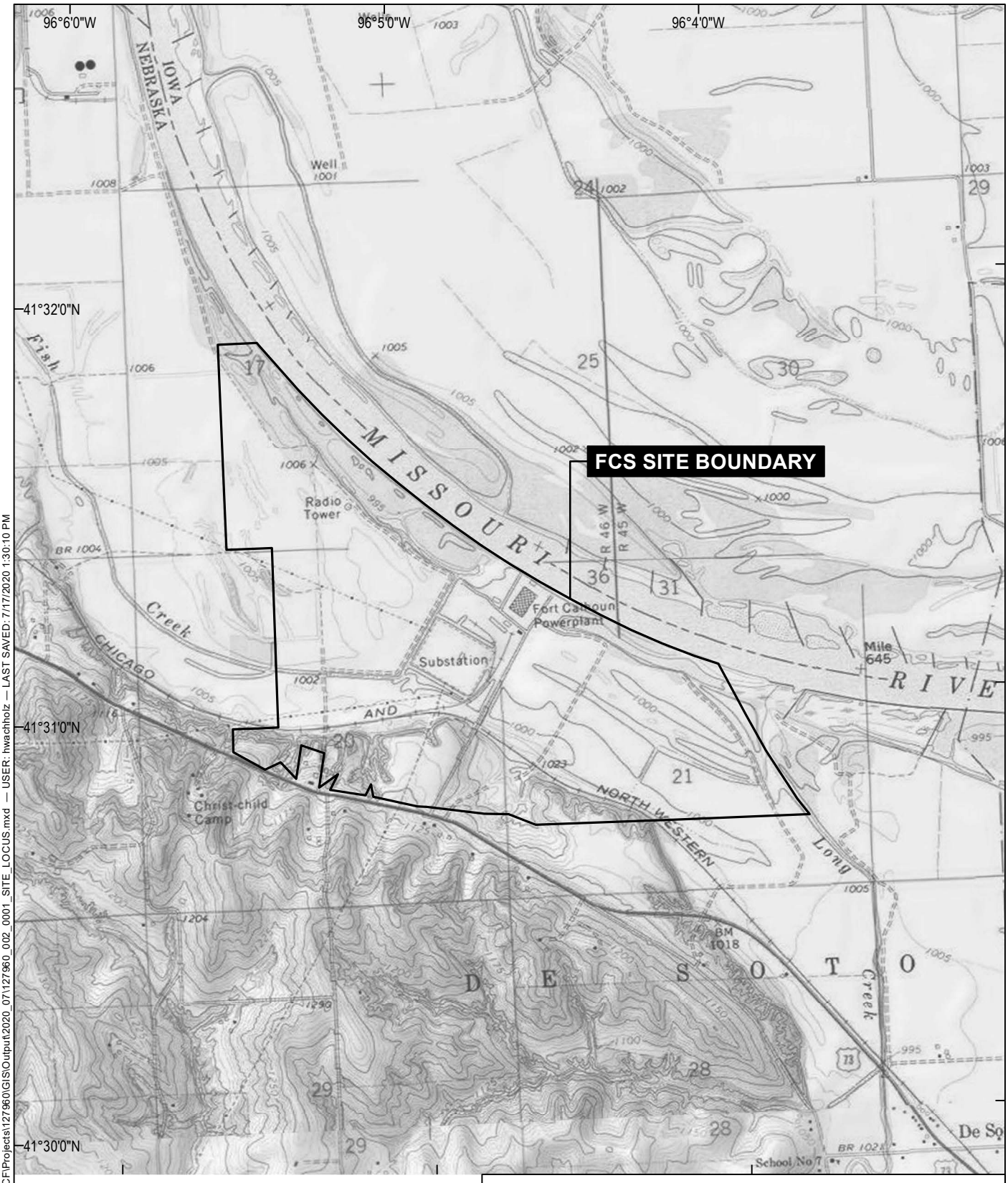
Location	Estimated K (cm/s)	GeoMean
MW-1A	9.05E-03	
MW-1A	2.34E-02	
MW-1A	1.17E-02	
MW-1A	1.40E-02	1.4E-02
MW-2	1.89E-02	
MW-2	1.64E-02	
MW-2	1.80E-02	
MW-2	1.57E-02	1.7E-02
MW-3A	8.75E-03	
MW-3A	1.03E-02	
MW-3A	1.08E-02	
MW-3A	9.11E-03	9.7E-03
MW-3B	1.32E-02	
MW-3B	1.61E-02	
MW-3B	1.55E-02	
MW-3B	1.38E-02	1.5E-02
MW-5A	9.28E-03	
MW-5A	8.55E-03	
MW-5A	1.04E-02	
MW-5A	9.56E-03	9.4E-03
MW-5B	1.76E-02	
MW-5B	1.69E-02	
MW-5B	1.81E-02	
MW-5B	2.07E-02	1.8E-02

TABLE 5-3
SUMMARY OF IN-SITU BOREHOLE PERMEABILITY TEST RESULTS
FORT CALHOUN STATION
BLAIR, NEBRASKA

Test Boring No.	Test Date	Ground Surface Elevation	Top Elevation of Test Zone	Bottom Elevation of Test Zone	Soil Stratum of Test Zone	Coefficient of Permeability, k Schmid (cm/sec)	Coefficient of Permeability, k ILRI (cm/sec)	Coefficient Permeability, k Jarvis (cm/sec)	Average Coefficient of Permeability, k (cm/sec)
SB-08	NA	0	-3.92	-5	fine to medium silt/sand, fairly dense	4E-05	2E-04	4E-05	9E-05
SB-11	NA	0	-3.8333	-5	fine to medium silt, dense	2E-06	4E-06	7E-07	2E-06
SB-17	NA	0	-4.0417	-5	medium to coarse sand AND fine to medium silt	1E-05	4E-05	8E-06	2E-05
SB-25	NA	0	-4	-5	Medium sand AND fine silt	5E-05	2E-04	4E-05	9E-05
SB-32	NA	0	-4	-5	fine to medium sand	1E-04	9E-04	2E-04	4E-04
SB-33	NA	0	-4	-5	fine to medium silt, dense	2E-05	4E-05	9E-06	2E-05

NOTES:
1. Tests were in-situ borehole permeability tests performed by the falling head method by a representative of Haley & Aldrich using Solinst level loggers to monitor the changes in groundwater elevations during the falling head test.

FIGURES



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MAP SOURCE: USGS
SITE COORDINATES: 41°31'12"N, 96°04'45"W

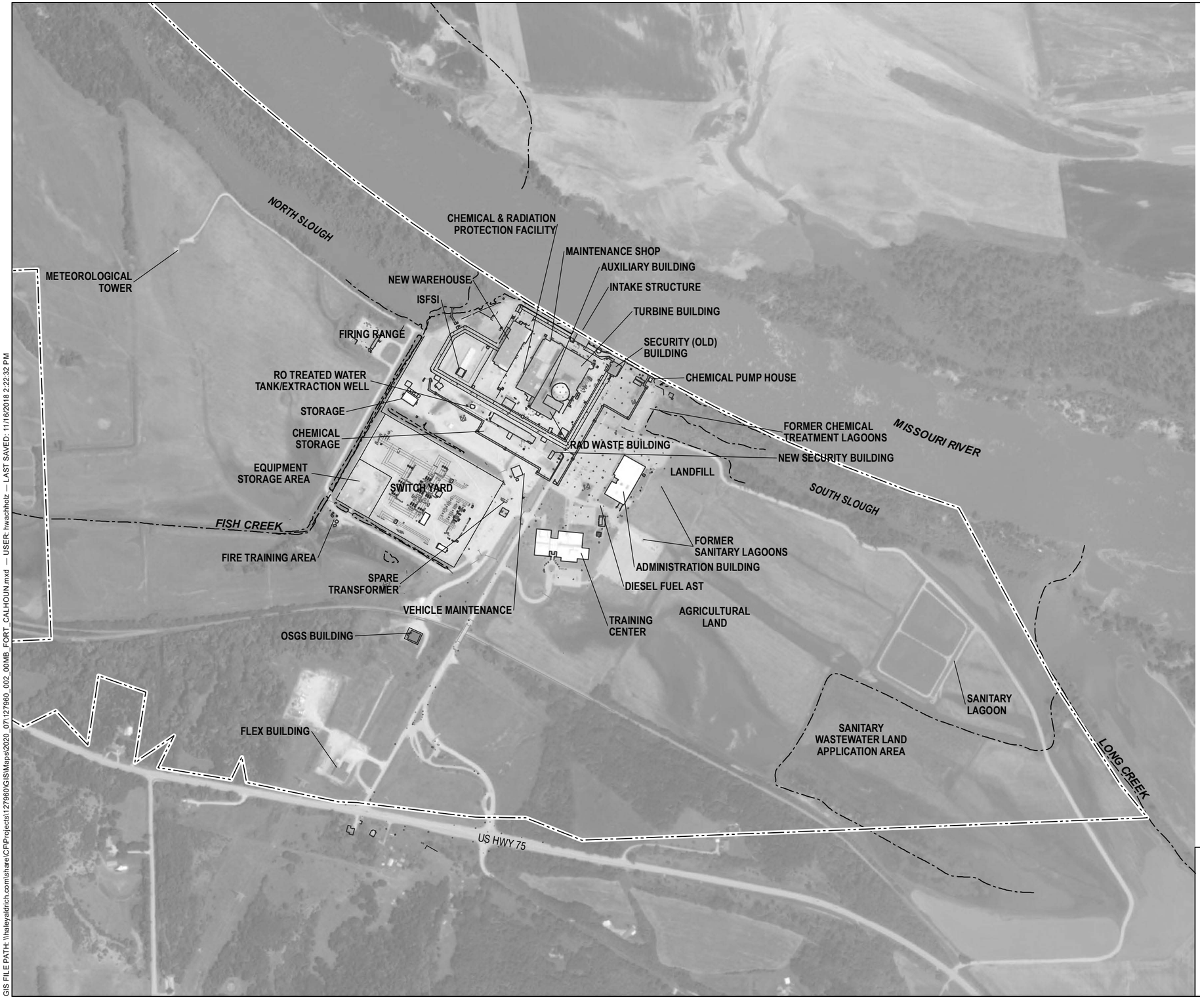
HALEY ALDRICH

FORT CALHOUN STATION
POWER LANE
BLAIR, NEBRASKA

SITE LOCUS

APPROXIMATE SCALE: 1 IN = 2000 FT
JULY 2020

FIGURE 1-1



LEGEND

- EXISTING BUILDING
- UTILITY
- STREAM
- PROPERTY BOUNDARY

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI

N

0 700 1,400

SCALE IN FEET

HALEY ALDRICH

FORT CALHOUN STATION
POWER LANE
BLAIR, NEBRASKA

SITE PLAN

JULY 2020

FIGURE 1-2

MAINTENANCE SHOP
INTAKE STRUCTURE
FIRING RANGE
TURBINE BUILDING
NEW WAREHOUSE
CHEMICAL & RADIATION PROTECTION FACILITY
SECURITY BUILDING
MISSOURI RIVER
ISFSI
CHEMICAL PUMP HOUSE
CHEMICAL STORAGE
AUXILIARY BUILDING
FORMER CHEMICAL TREATMENT LAGOONS
RO UNIT
RAD WASTE BUILDING
OLD WAREHOUSE
INDUSTRIAL RD
CHEMICAL STORAGE
NEW SECURITY BUILDING
LANDFILL
ADMINISTRATION BUILDING
EQUIPMENT STORAGE AREA
SWITCH YARD
SPARE TRANSFORMER
FIRE PROTECTION EQUIPMENT
FORMER SANITARY LAGOONS
FIRE TRAINING AREA
DIESEL FUEL AST
FISH CREEK
TRAINING CENTER
POWER LN
AGRICULTURAL LAND
OSGS BUILDING

LEGEND

- EXISTING BUILDING
- UTILITY
- STREAM OR BODY OF WATER
- PROPERTY BOUNDARY
- MAJOR TOPOGRAPHIC CONTOUR, 5' CONTOUR INTERVAL
- MINOR TOPOGRAPHIC CONTOUR, 1' CONTOUR INTERVAL

NOTES

1. STREAM DATA SOURCE: NATIONAL HYDROGRAPHY DATASET
2. WETLAND DATA SOURCE: NATIONAL WETLAND INVENTORY
3. AERIAL IMAGERY SOURCE: ESRI 2015

PLANT NORTH
TRUE NORTH

0 150 300 600
SCALE IN FEET

SITE TOPOGRAPHY

FORT CALHOUN NUCLEAR PLANT
POWER LANE, BLAIR, NEBRASKA

FIGURE 2-1
JULY 2020

HALEY ALDRICH

LEGEND

- EXISTING BUILDING
- UTILITY
- STREAM OR BODY OF WATER
- PROPERTY BOUNDARY
- WETLAND

NOTES

1. STREAM DATA SOURCE: NATIONAL HYDROGRAPHY DATASET
2. WETLAND DATA SOURCE: NATIONAL WETLAND INVENTORY
3. AERIAL IMAGERY SOURCE: ESRI 2015

PLANT NORTH

TRUE NORTH

0 350 700 1,400

SCALE IN FEET

SURFACE WATER FEATURES

FORT CALHOUN NUCLEAR PLANT
POWER LANE, BLAIR, NEBRASKA

FIGURE 2-2
JULY 2020

HALEY ALDRICH

LEGEND

- MONITORING WELL
- PROPERTY BOUNDARY
- STREAM

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. AERIAL IMAGERY SOURCE: ESRI

N

0 300 600

SCALE IN FEET

HALEY ALDRICH

FORT CALHOUN STATION
POWER LANE
BLAIR, NEBRASKA

GROUNDWATER MONITORING WELLS

JULY 2020

FIGURE 3-1

LEGEND

- MONITORING WELL WITH GROUNDWATER ELEVATION, IN FEET
- GROUNDWATER FLOW DIRECTION
- GROUDWATER ELEVATION CONTOUR, 0.1-FT INTERVAL
- INFERRED GROUNDWATER ELEVATION CONTOUR, 0.1-FT INTERVAL

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.
2. GROUNDWATER ELEVATIONS WERE COLLECTED 16 JUNE 2020 THROUGH 17 JUNE 2020.
3. AERIAL IMAGERY SOURCE: ESRI

N

0 200 400

SCALE IN FEET

HALEY ALDRICH

FORT CALHOUN STATION
POWER LANE, BLAIR, NEBRASKA

SHALLOW GROUNDWATER CONTOUR PLAN

JULY 2020

FIGURE 5-1

GIS FILE PATH: \\haleyaldrich.com\share\bos_common\127960-Ft_Calhoun\Global\xGIS\Maps\2020_07\127960_000_00MB_GROUNDWATER_CONTOURS.mxd — USER: hwachholz — LAST SAVED: 7/14/2020 10:03:53 AM

LEGEND

- MONITORING WELL WITH GROUNDWATER ELEVATION, IN FEET
- GROUNDWATER FLOW DIRECTION
- GROUDWATER ELEVATION CONTOUR, 0.1-FT INTERVAL
- INFERRED GROUNDWATER ELEVATION CONTOUR, 0.1-FT INTERVAL

NOTES

1. ALL LOCATIONS ARE APPROXIMATE.
2. GROUNDWATER ELEVATIONS WERE COLLECTED 16 JUNE 2020 THROUGH 17 JUNE 2020.
3. AERIAL IMAGERY SOURCE: ESRI

N

0 200 400
SCALE IN FEET

HALEY ALDRICH

FORT CALHOUN STATION
POWER LANE, BLAIR, NEBRASKA

DEEP GROUNDWATER CONTOUR PLAN

JULY 2020

FIGURE 5-2

GIS FILE PATH: \\haleyaldrich.com\share\bos_common\127960-FL_CalhounGlobalx\GIS\Maps\2020_07\127960_000_00MB_GROUNDWATER_CONTOURS.mxd — USER: hwachholz — LAST SAVED: 7/14/2020 10:03:53 AM

APPENDIX A

Field Forms

TEST BORING REPORT

Boring No. SB-01

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 42	0.0 5.0			SM	0.0-0.4 ft, white gravel 0.4-1.2 ft, brown fine to medium SAND (SM), some silt, no odor, dry										
							1.2-1.6 ft, white stone and gravel										
						SM	1.6-4.1 ft, brown medium to coarse SAND (SM), some gravel, loose, no odor, dry										
							4.1-4.6, white stone and gravel										
					4.6												
5		S2 42	5.0 10.0			ML	4.6-5.0 ft, brown medium sandy SILT (ML), dense, no odor, dry										
						ML	5.0-7.8 ft, brown to gray fine to medium SILT (ML), dense, no odor, dry										
						ML	7.8-8.5 ft, brown to gray fine to medium SILT (ML), dense, no odor, damp										
					8.5												
						SM	8.5-10.0 ft, brown medium SAND (SM), no odor, wet										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-01

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-02

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 33	0.0 5.0			ML	0.0-0.7 ft, loose white stone and gravel 0.7-5.0 ft, brown to reddish-brown fine to medium SILT (ML), dry										
5		S2 44	5.0 10.0		5.4	ML	5.0-5.4 ft, brown to reddish-brown fine to medium SILT (ML), no odor, dry										
					5.9	SM	5.4-5.9 ft, brown medium to coarse SAND (SM), no odor, dry										
						ML	5.9-8.2, brown fine to medium SILT (ML), no odor, moist 8.2-8.8 ft, brown fine to medium SILT (ML), some sand, no odor, damp										
						ML	8.8-10.0 ft, dark brown to gray fine to medium SILT (ML), very dense, no odor, dry										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-02

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-03

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 40	0.0 5.0			SM	0.0-0.6 ft, white gravel 0.6-2.8 ft, brown and gray SAND with gravel (SM), loose, no odor, dry -FILL-										
					2.8	ML	2.8-5.0 ft, brown to reddish-brown fine to medium SILT (ML), dense, no odor, dry										
5		S2 56	5.0 10.0			ML	5.0-8.6 ft, same										
						ML	8.6-10.0, same, except moist										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-03

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-04

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 46	0.0 5.0			ML	0.0-0.2 ft, stone and gravel 0.2-5.0 ft, brown to reddish-brown fine to medium SILT (ML), dense, no odor, dry										
5		S2 50	5.0 10.0			ML	5.0-8.1 ft, same										
						ML	8.1-8.6 ft, same, except less dense, moist										
						ML	8.6-9.7 ft, brown to reddish-brown fine to medium SILT (ML), dense, no odor, dry										
10					10.0		9.7-10.0 ft, white stone BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-04

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-05

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 50	0.0 5.0				0.0-0.9 ft, white GRAVEL and STONE										
						ML	0.9-2.0 ft, dark brown fine to medium SILT (ML), some gravel and stone										
						ML	2.0-3.9 ft, dark brow to gray fine to medium SILT (ML), dense										
					3.9	SM	3.9-4.4 ft, dark brown to gray fine to medium SAND (SM), no odor, damp										
					4.4	ML	4.4-5.0 ft, dark brown to gray fine to medium SILT (ML), trace sand, loose, no odor, moist										
5		S2 33	5.0 10.0			ML	5.0-5.4, same										
						ML	5.4-8.5, gray fine to medium SILT (ML), trace sand, no odor, damp										
					8.5	SM	8.5-10.0 ft, light brown to brown medium SAND (SM), no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-05

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-06

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 58	0.0 5.0				0.0-1.1, white GRAVEL and STONE 1.1-2.0 ft, brown coarse SAND and GRAVEL and STONE										
					2.0	ML	2.0-3.6 ft, dark brown to gray fine to medium SILT (ML), dense, no odor, dry										
					3.6	SM	3.6-4.0 ft, dark brown to gray fine to medium SAND (SM), some silt, no odor, damp to wet										
					4.0	ML	4.0-4.5 ft, dark brown fine SILT (ML), dense, no odor, moist										
5		S2 30	5.0 10.0			ML	4.5-5.0 ft, dark brown to gray fine to medium SILT (ML) some sand, no odor, damp										
						ML	5.0-8.1 ft, same										
					8.1	SM	8.1-9.0 ft, light brown medium SAND (SM), no odor, damp										
						SM	9.0-9.8, brown to dark brown fine to medium SAND (SM), no odor, damp										
					9.8	ML	9.8-10.0 ft, dark brown to gray fine to medium SILT (ML), dense, no odor, moist										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-06

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-07

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 45	0.0 5.0				0.0-2.2 ft, white GRAVEL and STONE										
						ML	2.2-3.1 ft, brown fine to medium SILT (ML), trace gravel, no odor, dry										
						ML	3.1-4.1 ft, brown fine to medium SILT (ML), no odor, dry										
							4.1-4.4 ft, white stone										
						ML	4.4-5.0 ft, brown fine to medium SILT (ML), no odor, dry										
5		S2 42	5.0 10.0				5.0-5.8 ft, same										
						ML	5.8-7.2 ft, grayish-brown fine to medium SILT (ML), dense, no odor, moist										
						ML	7.2-9.2 ft, gray fine to medium SILT (ML), loose, no odor, moist										
					9.2												
						SM	9.2-10.0 ft, gray medium SAND (SM), some silt, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-07

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-08

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 12, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 47	0.0 5.0			ML	0.0-2.2 ft, white and brown stone and gravel 2.2-3.1 ft, dark brown and gray fine to medium SILT (ML), dense, no odor, dry										
					3.1	SM	3.1-3.9 ft, brown medium to coarse SAND (SM), dense, no odor, dry										
					3.9	ML											
					4.2	SM	3.9-4.2 ft, gray fine to medium SILT (ML), loose no odor, moist										
5		S2 28	5.0 10.0			SM	4.2-5.5 ft, light gray to gray fine to medium SAND (SM), trace silt, no odor, damp										
					5.6	ML	5.0-5.6 ft, same 5.6-8.2 ft, gray fine to medium SILT (ML), some sand, dense, no odor, moist										
					8.2	SM/ML	8.2-10.0 ft, gray fine to medium SAND and SILT (SM/ML), dense, no odor, moist										
10		S3 60	10.0 15.0		10.0	SM	10.0-11.6 ft, same										
						SM	11.6-12.4 ft, gray fine to medium SILT (ML), some sand, no odor, damp										
					12.4	ML	12.4-14.1 ft, gray medium SAND (SM), trace silt, no odor, wet										
					14.4	ML	14.1-14.4 ft, gray fine to medium SILT (ML), trace sand, no odor, wet										
15		S4 60	15.0 20.0			SM											
						SM	14.4-15.0 ft, gray fine to medium SAND (SM), trace silt, no odor, wet 15.0-18.1 ft, same										
						SM	18.1-20.0 ft, gray medium to coarse SAND (SM), no odor, wet										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-08

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-09

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 33	0.0 5.0		0.4		0.0-0.4 ft -ASPHALT-										
					0.8	ML	0.4-0.8 ft, gray gravel subbase										
						ML	0.8-3.3 ft, brown fine to medium SILT (ML), dense, no odor, dry										
							3.3-3.6 ft, white stone										
						ML	3.6-3.9 ft, brown fine to medium SILT (ML), dense, no odor, dry										
						ML	3.9-4.4 ft, brown fine to medium SILT (ML), loose, no odor, damp										
						ML	4.4-5.0 ft, brown to gray fine to medium SILT (ML), dense, no odor, dry										
5		S2 43	5.0 10.0			ML	5.0-8.7 ft, brown to gray fine to medium SILT (ML), no odor, moist										
						ML	8.7-10.0 ft, brown to gray fine to medium SILT (ML), some sand, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-09

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-10

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

File No.	127960-006
Sheet No.	1 of 1
Start	June 8, 2020
Finish	June 8, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 35	0.0 5.0				0.0-0.8 -CONCRETE-										
					0.8	ML	0.8-4.1 ft, brown fine to medium SILT (ML), no odor, dry										
					4.1	SM	4.1-4.3 ft, light brown to gray medium to coarse SAND (SM), loose, no odor, moist										
5		S2 38	5.0 10.0			SM	4.3-5.0 ft, dark brown to gray medium to coarse SAND (SM), trace silt, no odor, moist										
						SM	5.0-5.8 ft, same										
						SM	5.8-7.1 ft, brown coarse SAND (SM)										
					7.1	ML	7.1-8.4 ft, dark gray fine to medium SILT (ML), no odor, damp										
					8.4	SM	8.4-9.6 ft, dark brown to gray fine to medium SAND (SM), trace silt, no odor, wet										
					9.6	ML	9.6-10.0 ft, dark brown to gray fine to medium SILT (ML), dense, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-10

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-11

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 8, 2020
Finish	June 18, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)
0		S1 35	0.0 5.0		0.4		0.0-0.4 ft -CONCRETE-
					0.9	ML	0.4-0.9 ft, gray gravel -SUBBASE-
							0.9-3.1 ft, brown fine to medium SILT (ML), dense, no odor, dry
						ML	3.1-3.9 ft, brown fine to medium SILT (ML), loose, no odor, dry
					3.9	SM	3.9-4.4 ft, brown medium to coarse SAND (SM), no odor, moist
					4.4	ML	4.4-5.0 ft, fine to medium SILT (ML), dense, no odor, dry
5		S2 53	5.0 10.0			ML	5.0-7.2 ft, same
						ML	7.2-8.1 ft, less dense fine to medium SILT (ML), no odor, damp
						ML	8.1-8.9 ft, fine to medium SILT (ML), no odor, wet
					9.5	ML SM	8.9-9.5 ft, gray fine to medium SILT (ML), trace sand, no odor, damp
10		S3 60	10.0 15.0		10.0	ML	9.5-9.8 ft, black fine to medium SAND (SM), some silt, no odor, damp
						ML	9.8-10.0 ft, white stone
							10.0-11.2 ft, gray fine to medium SILT (ML), trace sand, dense, no odor, wet
					13.2	ML SM	11.2-12.0 ft, dark gray to black fine to medium SILT (ML), dense, no odor, wet
							12.7-13.2 ft, gray fine to medium SILT (ML), some sand, loose, no odor, wet
15		S4 51	15.0 20.0				13.2-15.0 ft, brown to reddish-brown medium to coarse SAND (SM), no odor, wet
							15.0-18.6 ft, same
						SM	18.6-20.0 ft, brown coarse SAND (SM), no odor, wet
20					20.0		BOTTOM OF EXPLORATION 20.0 FT

Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-11

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-12

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 8, 2020
Finish	June 8, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 48	0.0 5.0		0.4	ML	0.0-0.4 ft -CONCRETE-										
							0.4-4.2 ft, brown fine to medium SILT (ML), dense, no odor, dry										
					4.2	SM	4.2-5.0 ft, brown fine to medium SAND (SM), trace silt, dense, no odor, dry										
5		S2 45	5.0 10.0			SM	5.0-5.8 ft, same										
					5.8	ML	5.8-7.8 ft, brown fine to medium SILT (ML), dense, no odor, moist										
						ML	7.8-8.9 ft, brown fine to medium SILT (ML), loose, no odor, damp										
						ML	8.9-9.4 ft, gray SILT (ML), dense, no odor, moist										
					9.4	SM	9.4-9.8 ft, brown to gray-brown medium SAND (SM), trace silt, no odor, damp										
10					10.0	SM	9.8-10.0 ft, brown to grayish-brown medium SAND (SM), some silt, dense, no odor, moist										
							BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-12

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-13

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 8, 2020
Finish	June 8, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 40	0.0 5.0		0.4		0.0-0.4 -CONCRETE-										
						ML	0.4-1.1 ft, light brown fine to medium SILT (ML), no odor, dry										
						ML	1.1-5.0 ft, brown fine to medium SILT (ML), dense, no odor, dry										
5		S2 53	5.0 10.0			ML	5.5-5.6 ft, same										
							5.6-5.9 ft, white gravel										
						ML	5.9-7.1 ft, brown fine to medium SILT (ML), dense, no odor, dry										
						ML	7.1-8.3 ft, brown fine to medium SILT (ML), dense, no odor, damp										
						ML	8.6-10.0 ft, brown fine to medium SILT (ML), dense, no odor, damp										
						ML	8.3-8.6 ft, gray fine to medium SILT (ML), dense, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-13

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-14

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 10, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 43	0.0 5.0			(SM/GM)	0.0-0.7 ft, gray SAND and GRAVEL (SM/GM)										
						(SM/GM)	0.7-2.1 ft, brown medium SAND and GRAVEL (SM/GM), some silt, loose										
					2.1	ML/SM	2.1-3.0 ft, brown fine to medium SILT and SAND (ML/SM)										
					3.0	SM	3.0-3.7 ft, light brown to brown medium to coarse SAND (SM), some silt										
						SM	3.7-3.9 ft, white stone 3.9-5.4 ft, light brown to reddish-brown medium SAND (SM), no odor, moist										
5		S2 32	5.0 10.0				5.0-8.4 ft, same										
					8.4	ML	8.4-8.7 ft, brown fine to medium SILT (ML), no odor, moist										
					8.7	SM	8.7-9.4 ft, light brown to reddish-brown medium SAND (SM), no odor, moist										
					9.7	SM	9.4-9.8 ft, light brown to reddish-brown medium SAND (SM), no odor, damp										
10					10.0	ML	9.8-10.0 ft, brown fine to medium SILT (ML), no odor, moist BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 10 Rock Cored (ft) - Samples 2S **Boring No. SB-14**

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-15

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 10, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 40	0.0 5.0			ML	0.0-0.6 ft, white GRAVEL and STONE 0.6-3.4 ft, brown fine to medium SILT (ML), dense, no odor, dry										
					3.6	SM	3.4-3.6 ft, white stone 3.6-5.0 ft, light brown to brown medium SAND (SM), no odor, moist										
5		S2 36	5.0 10.0			SM	5.0-5.8 ft, same										
					5.8	ML ML	5.8-6.1 ft, brown fine to medium SILT (ML), some sand, no odor, moist 6.1-10.0 ft, light brown to brown medium to coarse SAND (ML), no odor, moist										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-15

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-16

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 10, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 32	0.0 5.0				0.0-0.5 ft, landscaping stone										
						ML	0.5-3.3 ft, brown to dark brown fine to medium SILT (ML), trace sand, no odor, dry										
						ML	3.3-3.9 ft, same, except moist										
						ML	3.9-4.1 ft, white stone 4.1-4.8 ft, brown to reddish-brown fine to medium SILT (ML), no odor, moist										
5		S2 23	5.0 10.0			ML	4.8-5.0 ft, white stone 5.0-9.1 ft, brown fine to medium SILT (ML), no odor, damp										
					9.1												
						SM	9.1-9.5 ft, light brown to brown medium to coarse SAND (SM), trace silt, no odor, damp										
					9.5	ML											
10					10.0		9.5-10.0 ft, brown to dark brown fine to medium SILT (ML), no odor, samp										
							BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-16

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-17

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 18, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 45	0.0 5.0			ML	0.0-0.7 ft, white GRAVEL and STONE 0.7-3.9 ft, brown fine to medium SILT (ML), some sand, no odor, dry										
					3.9	SM	3.9-4.3 ft, brown medium to coarse SAND (SM), loose, no odor, dry										
					4.3	ML	4.3-5.0 ft, brown fine to medium SILT (ML), dense, no odor, dry										
5		S2 33	5.0 10.0			ML	5.0-6.1 ft, same										
					6.1	SM	6.1-9.6 ft, tan to white medium to coarse SAND (SM), loose, no odor, damp										
					9.6	ML											
10		S3 58	10.0 15.0			ML	10.0-12.1 ft, brown to gray fine to medium stiff SILT (ML), dense, no odor, damp										
						ML	12.1-12.8 ft, black fine to medium SILT (ML), some sand, no odor, damp										
						ML	12.8-15.0 ft, gray to black fine to medium SILT (ML), some sand, dense, no odor, wet										
15		S4 57	15.0 20.0			ML	15.0-15.6 ft, same										
					15.6	SM	15.6-20.0 ft, grayish-brown medium to coarse SAND (SM), no odor, wet										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-17

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-18

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 11, 2020
Finish	June 11, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 40	0.0 5.0		0.4		0.0-0.4 ft -CONCRETE										
						ML	0.4-1.2 ft, brown fine to medium SILT (ML), no odor, dry										
						ML	1.2-3.3 ft, brown to reddish-brown fine to medium SILT (ML), some sand, no odor, dry										
						ML	3.3-4.0 ft, brown to reddish-brown fine to medium SILT (ML), no odor, dry										
					4.4	ML	4.0-4.4 ft, same, except moist										
5		S2 30	5.0 10.0			SM	4.4-5.0 ft, light brown to brown medium to coarse SAND (SM), no odor, moist										
						SM	5.0-5.4 ft, same										
						SM	5.4-8.6 ft, brown fine to medium SAND (SM), trace silt, no odor, moist										
					8.6	ML	8.6-8.9 ft, brown fine to medium SILT (ML), dense, no odor, dry										
					8.9	SM	8.9-10.0 ft, tan to light brown medium to coarse SAND (SM), no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-18

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-19

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 10, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 46	0.0 5.0				0.0-1.2 ft, white GRAVEL and STONE										
						SM/ML	1.2-4.2 ft, brown medium SAND and SILT (SM/ML), trace gravel, no odor, dry										
						SM/ML	4.2-4.4 ft, white stone										
					4.8		4.4-4.8 ft, brown medium SAND and SILT (SM/ML), trace gravel, no odor, moist										
5		S2 34	5.0 10.0			SM	4.8-5.0 ft, tan to white coarse SAND (SM), loose, no odor, moist										
						SM	5.0-9.2 ft, same										
					9.6	SM	9.2-9.6 ft, brown fine to medium SAND (SM), no odor, damp										
10					10.0	ML	9.6-10.0 ft, brown fine to medium SILT (ML), dense, no odor, moist										
							BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-19

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-20

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 10, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 51	0.0 5.0				0.0-0.7 ft, white GRAVEL and STONE										
						ML	0.7-3.7 ft, brown to reddish-brown fine to medium SILT (ML), dense, no odor, dry										
						ML	3.7-5.0 ft, brown to reddish-brown fine to medium SILT (ML), no odor, moist										
5		S2 42	5.0 10.0			ML	5.0-7.1 ft, same										
						ML	7.1-8.4 ft, gray to dark gray fine to medium SILT (ML), dense, no odor, dry										
					8.4	SM	8.4-9.7 ft, brown to reddish-brown medium to coarse SAND (SM), loose, no odor, moist										
					9.7	ML	9.7-10.0 ft, dark brown to gray fine to medium SILT (ML), some sand, dense, no odor, dry										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-20

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-21

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 10, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 57	0.0 5.0			SM/ML	0.0-0.4 ft, white GRAVEL and STONE 0.4-2.2 ft, brown medium SAND and SILT (SM/ML), some gravel, no odor, dry -FILL-										
					2.7		2.2-2.7 ft, white GRAVEL and STONE										
						SM	2.7-3.8 ft, reddish-brown fine to medium SAND (SM), some silt, no odor, dry										
					3.8												
						ML	3.8-5.0 ft, reddish-brown to gray fine to medium SILT (ML), dense, no odor, dry										
5		S2 49	5.0 10.0			ML	5.0-7.6 ft, same										
					7.6												
						SM	7.6-8.3 ft, brown medium SAND (SM), trace silt, no odor, damp										
					8.3												
						ML	8.3-9.2 ft, reddish-brown to gray fine to medium SILT (ML), no odor, moist										
					9.2												
						SM	9.2-10.0 ft, reddish-brown fine to medium SAND (SM), some silt, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-21

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-22

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 10, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 57	0.0 5.0				0.0-0.5 ft, white GRAVEL and STONE										
						ML	0.5-1.9 ft, light brown to brown fine to medium SILT (ML), some gravel, no odor, dry										
						ML	1.9-3.2 ft, brown to dark brown fine to medium SILT (ML), no odor, moist										
							3.2-3.6 ft, white GRAVEL and STONE										
						ML	3.6-5.0 ft, dark brown to gray fine to medium SILT (ML), trace sand, no odor, moist										
5		S2 32	5.0 10.0			ML	5.0-8.1 ft, same										
						ML	8.1-8.7 ft, same, except brown										
					8.7	SM	8.7-9.4 ft, brown fine to medium SAND (SM), some silt, no odor, damp										
					9.4	ML	9.4-10.0 ft, brown fine to medium SILT (ML), some sand, no odor, damp										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 10 Rock Cored (ft) - Samples 2S **Boring No. SB-22**

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-23

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 10, 2020
Finish	June 10, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 35	0.0 5.0		0.5		0.0-0.5 ft -CONCRETE										
							0.5-3.7 ft, brown and gray fine to medium SILT and SAND, some gravel -FILL-										
					3.9	ML	3.7-3.9 ft, white stone										
					4.5	SM	3.9-4.5 ft, brown to reddish-brown fine to medium SILT (ML), trace sand, no odor, moist										
5		S2 44	5.0 10.0		5.4	SM	4.5-5.0 ft, brown to reddish brown medium to coarse SAND (SM), no odor, damp										
						ML	5.0-5.4 ft, same										
							5.4-7.2 ft, brown fine to medium SILT (ML), trace sand, no odor, moist										
						ML	7.2-8.1 ft, brown fine to medium SILT (ML), some sand, no odor, wet										
						ML	8.1-10.0 ft, brown to dark brown fine to medium SILT (ML), dense, no odor, dry										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data

Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID

O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram

Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-23

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-24

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 9, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 41	0.0 5.0		0.6		0.0-0.6 ft, white GRAVEL and STONE										
						SM/ML	0.6-3.3 ft, loose white and brown SAND and GRAVEL (SM/ML) and STONE										
					3.3	ML	3.3-4.1 ft, brown fine to medium SILT (ML), trace sand, dense, no odor, dry										
					4.1	SM	4.1-4.7 ft, brown fine to medium SAND (SM), some silt, no odor, moist										
					4.7	ML	4.7-5.0 ft, brown to dark brown fine to medium SILT (ML), no odor, damp										
5		S2 32	5.0 10.0			ML	5.0-9.3 ft, same										
					9.3	SM	9.3-10.0 ft, brown to dark brown fine to medium SAND (SM), trace silt, no odor, wet										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-24

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-25

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 9, 2020
Finish	June 19, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 41	0.0 5.0		0.8		0.0-0.8 ft, white GRAVEL and STONE										
					1.7	SM	0.8-1.7 ft, brown SILT and SAND and GRAVEL -FILL-										
							1.7-4.4 ft, brown fine to medium SAND (SM), no odor, moist										
					4.4	ML	4.4-4.6 ft, brown fine SILT (ML), dense, no odor, damp										
5		S2 37	5.0 10.0		4.6	SM	4.6-5.0 ft, reddish-brown medium SAND (SM), no door, moist										
					5.7	SM	5.0-5.7 ft, same										
						ML	5.7-7.0 ft, dark brown to gray fine to medium SILT (ML), no odor, damp										
						ML	7.0-9.4 ft, dark gray fine to medium SILT (ML), dense, no odor, moist										
					9.4	SM	9.4-10.0 ft, brown medium SAND (SM), no odor, wet										
10		S3 58	10.0 15.0			SM	10.0-10.9 ft, same										
					10.9	ML	10.9-11.4 ft, dark gray fine to medium SILT (ML), no odor, damp										
							11.4-13.2 ft, dark brown to gray fine to medium SAND (SM), trace silt, no odor, damp										
					13.6	ML	13.2-13.6 ft, gray fine to medium SILT (ML), some sand, no odor, damp										
						SM	13.6-15.0 ft, brown to gray medium SAND (SM), no odor, wet										
15		S4 53	15.0 20.0			SM	15.0-17.8 ft, same										
						SM	17.8-20.0 ft, brown to gray medium to coarse SAND (SM), no odor, wet										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-25

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-31

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 17, 2020
Finish	June 17, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 26	0.0 5.0		0.4		0.0-0.4 ft -CONCRETE-										
						ML	0.4-2.6 ft, brown fine to medium SILT (ML), trace gravel, no odor, dry										
						ML	2.6-3.4 ft, brown fine to medium SILT (ML), no odor, moist										
						ML	3.4-5.0 ft, brown to reddish-brown SILT (ML), trace sand, no odor, moist										
5		S2 31	5.0 10.0			ML	5.0-7.6 ft, same										
						ML	7.6-8.1 ft, same, except wet										
						ML	8.1-8.6 ft, brown to reddish-brown SILT (ML), very dense, no odor, dry										
						ML	8.6-10.0 ft, brown to reddish-brown fine to medium SILT (ML), trace sand, no odor, moist										
10					10.0		BOTTOM OF EXPLORATION 10.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
O - Open End Rod
T - Thin Wall Tube
U - Undisturbed Sample
S - Split Spoon Sample

Well Diagram
Riser Pipe
Screen
Filter Sand
Cuttings
Grout
Concrete
Bentonite Seal

Summary	
Overburden (ft)	10
Rock Cored (ft)	-
Samples	2S

Boring No. SB-31

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-32

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 19, 2020
Finish	June 19, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 52	0.0 5.0		0.3	ML	0.0-0.3 ft TOPSOIL-										
					1.2	SM	0.3-1.2 ft, brown fine SILT (ML), dense, no odor, dry										
							1.2-2.9 ft, brown to reddish-brown fine silty SAND (SM), no odor, dry										
					2.9	ML	2.9-4.3 ft, brown fine to medium SILT (ML), no odor, moist										
					4.3	SM	4.3-4.8 ft, light brown fine to medium SAND (SM), no odor, moist										
5		S2 58	5.0 10.0		4.8	ML	4.8-5.0 ft, brown fine to medium SILT (ML), some sand, no odor, moist										
						ML	5.0-7.4 ft, same										
						ML	7.4-8.1 ft, brown to reddish-brown fine SILT (ML), dense, no odor, moist										
					8.1	SM	8.1-10.0 ft, brown to reddish-brown fine to medium SAND (SM), some silt, no odor, damp										
10		S3 58	10.0 15.0			SM	10.0-12.1 ft, same										
						SM	12.1-15.0 ft, same, except wet										
15		S4 57	15.0 20.0			SM	15.0-16.2 ft, same										
						SM	16.2-20.0 ft, brown to reddish-brown medium to coarse SAND (SM), some silt, no odor, wet										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-32

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

HALEY ALDRICH

TEST BORING REPORT

Boring No. SB-33

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 19, 2020
Finish	June 19, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 31	0.0 5.0		0.4	ML	0.0-0.4 -TOPSOIL/ORGANICS-										
						ML	0.4-1.3 ft, dark brown SILT (ML), loose 1.3-5.0 ft, dark brown fine to medium SILT (ML), no odor, dry										
5		S2 25	5.0 10.0			ML	5.0-8.9 ft, brown to dark brown fine to medium SILT (ML), no odor, moist										
						ML	8.9-10.0 ft, brown to dark brown fine to medium SILT (ML), trace sand, no odor, moist										
10		S3 39	10.0 15.0			ML	10.0-13.2 ft, brown to dark brown fine to medium SILT (ML), dense, no odor, moist										
						ML	13.2-15.0 ft, light brown to brown fine to medium SILT (ML), some sand, some organics (root material), no odor, moist										
15		S4 60	15.0 20.0			ML	15.0-16.3 ft, same										
					16.3	ML/SM	16.3-20.0 ft, light brown to brown fine to medium SILT and SAND (ML/SM), no odor, damp										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data					
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water

Sample ID
- O - Open End Rod
- T - Thin Wall Tube
- U - Undisturbed Sample
- S - Split Spoon Sample

Well Diagram
- Riser Pipe
- Screen
- Filter Sand
- Cuttings
- Grout
- Concrete
- Bentonite Seal

Summary

Overburden (ft)	20
Rock Cored (ft)	-
Samples	4S

Boring No. SB-33

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None
Toughness: L - Low M - Medium H - High
Plasticity: N - Nonplastic L - Low M - Medium H - High
Dry Strength: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

TEST BORING REPORT

Boring No. SB-34

Project	Fort Calhoun Station, Blair NE
Client	Energy*Solutions*
Contractor	Environmental Works, Inc.

File No.	127960-006
Sheet No.	1 of 1
Start	June 19, 2020
Finish	June 19, 2020
Driller	M. Gagnon
H&A Rep.	M. van Noordennen
Elevation Datum	
Location	See Plan

	Casing	Sampler	Barrel	Drilling Equipment and Procedures
Type		S	--	Rig Make & Model: Geoprobe
Inside Diameter (in.)		1.375	--	Bit Type:
Hammer Weight (lb)		140	-	Drill Mud: None
Hammer Fall (in.)		30	-	Casing:
				Hoist/Hammer: Automatic Hammer
				PID Make & Model: MiniRAE 3000

Depth (ft)	Sampler Blows per 6 in.	Sample No. & Rec. (in.)	Sample Depth (ft)	PID Readings (ppm)	Stratum Change Elev/Depth (ft)	USCS Symbol	VISUAL-MANUAL IDENTIFICATION AND DESCRIPTION (Density/consistency, color, GROUP NAME, max. particle size*, structure, odor, moisture, optional descriptions GEOLOGIC INTERPRETATION)	Gravel % Coarse	Gravel % Fine	Sand % Coarse	Sand % Medium	Sand % Fine	% Fines	Field Test Dilatancy	Field Test Toughness	Field Test Plasticity	Field Test Strength
0		S1 49	0.0 5.0				0.0-1.5 ft, gray GRAVEL and STONE										
					1.5	ML	1.5-4.3 ft, brown to reddish-brown very fine to fine SILT (ML), dense, no odor, dry										
						ML	4.3-5.0 ft, brown to gray fine to medium SILT (ML), dense, no odor, dry										
5		S2 51	5.0 10.0			ML	5.0-7.7 ft, same										
						ML	7.7-9.1 ft, gray fine to medium SILT (ML), some sand, no odor, moist										
					9.1	SM	9.1-10.0 ft, gray fine to medium SAND (SM), some silt, no odor, moist										
10		S3 51	10.0 15.0			SM	10.0-12.9 ft, same										
						SM	12.9-15.0 ft, brown to gray medium SAND (SM), no odor, wet										
15		S4 6	15.0 20.0			SM	15.0-19.2 ft, brown to gray medium to coarse SAND (SM), no odor, wet										
					19.2	ML	19.2-20.0 ft, dark gray fine to medium SILT (ML), trace sand, no door, wet										
20					20.0		BOTTOM OF EXPLORATION 20.0 FT										

Water Level Data						Sample ID	Well Diagram	Summary
Date	Time	Elapsed Time (hr.)	Depth (ft) to: Bottom of Casing	Bottom of Hole	Water	O - Open End Rod T - Thin Wall Tube U - Undisturbed Sample S - Split Spoon Sample	Riser Pipe Screen Filter Sand Cuttings Grout Concrete Bentonite Seal	Overburden (ft) 20 Rock Cored (ft) - Samples 4S **Boring No. SB-34**

Field Tests: **Dilatancy**: R - Rapid S - Slow N - None **Toughness**: L - Low M - Medium H - High **Plasticity**: N - Nonplastic L - Low M - Medium H - High **Dry Strength**: N - None L - Low M - Medium H - High V - Very High

***Note: Maximum particle size (mps) is determined by direct observation within the limitations of sampler size.**

Note: Soil identification based on visual-manual methods of the USCS as practiced by Haley & Aldrich, Inc.

APPENDIX B

Hydraulic Gradient and Groundwater Velocity Analyses

PROBLEM STATEMENT & OBJECTIVE

The purpose of this calculation set is to estimate the hydraulic horizontal gradients, vertical gradients, and velocity for Fort Calhoun Station in Blair, Nebraska based on field data collected in June 2020.

REFERENCES

1. Groundwater (1979) A. Freeze & J. Cherry, Chapter 2.1 - Darcy's Law.
2. Morris, D.A. and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey, U.S. Geological Survey Water-Supply Paper 1839-D, 42p.

AVAILABLE INFORMATION

1. Haley & Aldrich, June 2020 Shallow Groundwater Contour Plan, Fort Calhoun Station, Blair, Nebraska.
2. Haley & Aldrich, June 2020 Deep Groundwater Contour Plan, Fort Calhoun Station, Blair, Nebraska.
3. Haley & Aldrich, Slug Testing/Aquifer Testing Results, Fort Calhoun Station, Blair, Nebraska.
4. Haley & Aldrich, Well Construction Table, Fort Calhoun Station, Blair, Nebraska.

ASSUMPTIONS

1. For these calculations, gradient will be calculated according to Darcy's Law. Gradient is calculated by dividing the change in hydraulic head by the distance over which the head changes (Δh/ΔL). The change in head values will be calculated by taking the difference between two groundwater contours, and the distance between those two contours will be measured perpendicular to the contours. Vertical gradient will also be calculated for multi-level wells with the same Δh/ΔL approach.

2. Groundwater velocity will be calculated using the following equation from Darcy's Law:

$$V = (Ki)/n_e$$

Where:
V = Velocity (cm/sec)
K = Hydraulic Conductivity (cm/sec)
i = Horizontal Hydraulic Gradient (unitless)
n_e = Effective Porosity (unitless)

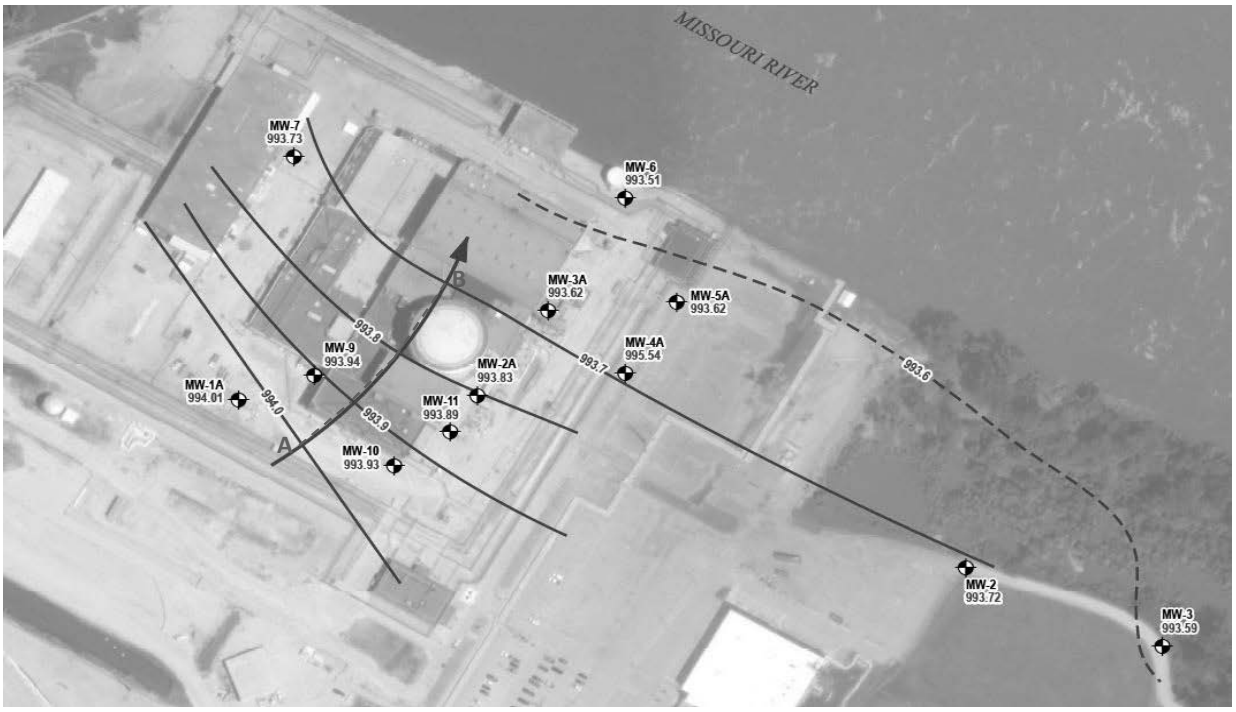
3. A range of hydraulic conductivity values will be used for the velocity calculations. Based on the slug testing results in the table below, we will use a range of 1x10-3 cm/sec to 1x10-2 cm/sec for these calculations.

Location	Estimated K (cm/s)		GeoMean
MW-1A	9.05E-03		
MW-1A	2.34E-02		
MW-1A	1.17E-02		
MW-1A	1.40E-02		**1.4E-02**
MW-2	1.89E-02		
MW-2	1.64E-02		
MW-2	1.80E-02		
MW-2	1.57E-02		**1.7E-02**
MW-3A	8.75E-03		
MW-3A	1.03E-02		
MW-3A	1.08E-02		
MW-3A	9.11E-03		**9.7E-03**
MW-3B	1.32E-02		
MW-3B	1.61E-02		
MW-3B	1.55E-02		
MW-3B	1.38E-02		**1.5E-02**
MW-5A	9.28E-03		
MW-5A	8.55E-03		
MW-5A	1.04E-02		
MW-5A	9.56E-03		**9.4E-03**
MW-5B	1.76E-02		
MW-5B	1.69E-02		
MW-5B	1.81E-02		
MW-5B	2.07E-02		**1.8E-02**

4. A range of effective porosity values will also be used for the velocity calculations. Based on ranges provided in Morris and Johnson 1967 for specific yield and porosity, we will assume a range of 0.15 to 0.25 for these calculations.

HORIZONTAL HYDRAULIC GRADIENT CALCULATIONS

1. Shallow Groundwater Calculations

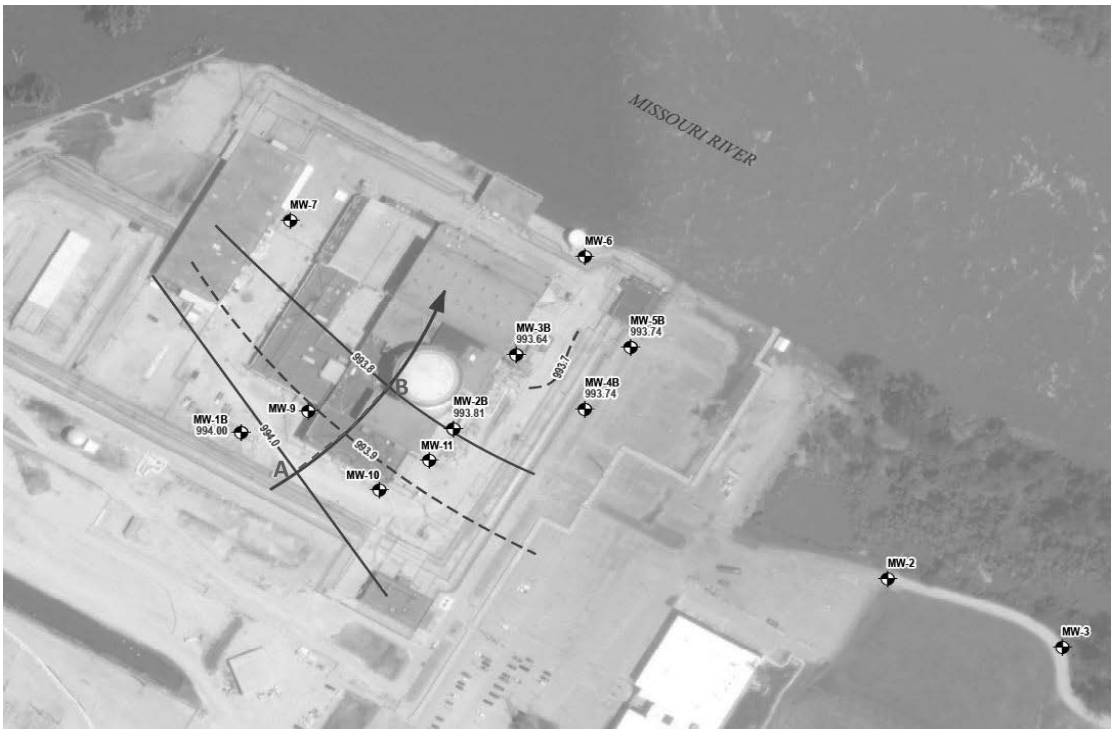


Calculation Line	Head 1 (ft)	Head 2 (ft)	Change in Head (Δh)	Distance in ft (ΔL)	Calculated Gradient
A - B	994.0	993.7	0.3	361.1	8.31E-04

Estimated Gradient	**=**	**8.31E-04**

HORIZONTAL HYDRAULIC GRADIENT CALCULATIONS

2. Deep Groundwater Calculations



Calculation Line	Head 1 (ft)	Head 2 (ft)	Change in Head (Δh)	Distance in ft (ΔL)	Calculated Gradient
A - B	994.0	993.8	0.2	235.5	8.5E-04

Estimated Gradient	**=**	**8.49E-04**

VERTICAL HYDRAULIC GRADIENT CALCULATIONS

1. Vertical hydraulic gradient is calculated by dividing the change in head by the change is distance over which the head change occurs (Δh/ΔL).

2. The change in head is calculated by finding the difference in groundwater elevation between the shallow and deep ports of the multi-level wells.

3. The distance used for these calculations is the difference in depth between the midpoint of the screen interval for both the shallow and deep ports on the multi-level wells. The "Depth" column refers to the screen midpoint depth for each port.

4. Estimated gradients are shown as either positive or negative values. A positive gradient indicates an upward gradient direction. A negative gradient indicates a downward gradient direction.

5. The estimated minimum, maximum, and average gradients presented on this page are calculated using only the magnitude of the estimated gradients. The negative/positive associations are indicative of direction only and are not included in the calculations of the minimum, maximum, and average gradients.

Well ID	Shallow Port (A)		Deep Port (B)		Change in Head	Distance	Estimated Vertical Gradient
	GWE (ft)	Depth bgs (ft)	GWE (ft)	Depth bgs (ft)	Δh	ΔL	Δh/ΔL
MW-1	994.01	19	994.00	47.5	0.01	28.5	0.0004
MW-2	993.83	19	993.81	47.5	0.02	28.5	0.0007
MW-3	993.62	18	993.64	47.5	-0.02	29.5	-0.0007
MW-4	995.54	17	993.74	47.5	1.8	30.5	0.0590
MW-5	993.62	17	993.74	47.5	-0.12	30.5	-0.0039

Minimum Vertical Hydraulic Gradient: **0.0004**

Maximum Vertical Hydraulic Gradient: **0.0590**

Average Vertical Hydraulic Gradient: **0.0129**

GROUNDWATER VELOCITY CALCULATIONS

$V = (Ki)/n_e$

Where:
V = Velocity (cm/sec)
K = Hydraulic Conductivity (cm/sec)
i = Horizontal Hydraulic Gradient (unitless)
n_e = Effective Porosity (unitless)

1. The velocity will be calculated using the average estimated gradient for each contour plan, as shown on previous pages of this calculation set.

2. The velocity will be calculated using a hydraulic conductivity range of $1x10^{-3}$ cm/sec to $1x10^{-2}$ cm/sec.

3. The velociity will be calculated using a range of effective porosity values of 0.15 to 0.25.

Shallow Groundwater Calculations

Hydraulic Conductivity (K) (cm/sec)	Gradient (unitless)	Effective Porosity (unitless)	Estimated Velocity	
			(cm/sec)	(ft/year)
1E-03	8.31E-04	0.15	5.54E-06	5.73
1E-02	8.31E-04	0.25	3.32E-05	34.39
1E-03	8.31E-04	0.15	5.54E-06	5.73
1E-02	8.31E-04	0.25	3.32E-05	34.39

Deep Groundwater Calculations

Hydraulic Conductivity (K) (cm/sec)	Gradient (unitless)	Effective Porosity (unitless)	Estimated Velocity	
			(cm/sec)	(ft/year)
1E-03	8.49E-04	0.15	6E-06	5.86
1E-02	8.49E-04	0.25	3E-05	35.16
1E-03	8.49E-04	0.15	6E-06	5.86
1E-02	8.49E-04	0.25	3E-05	35.16

SUMMARY OF RESULTS

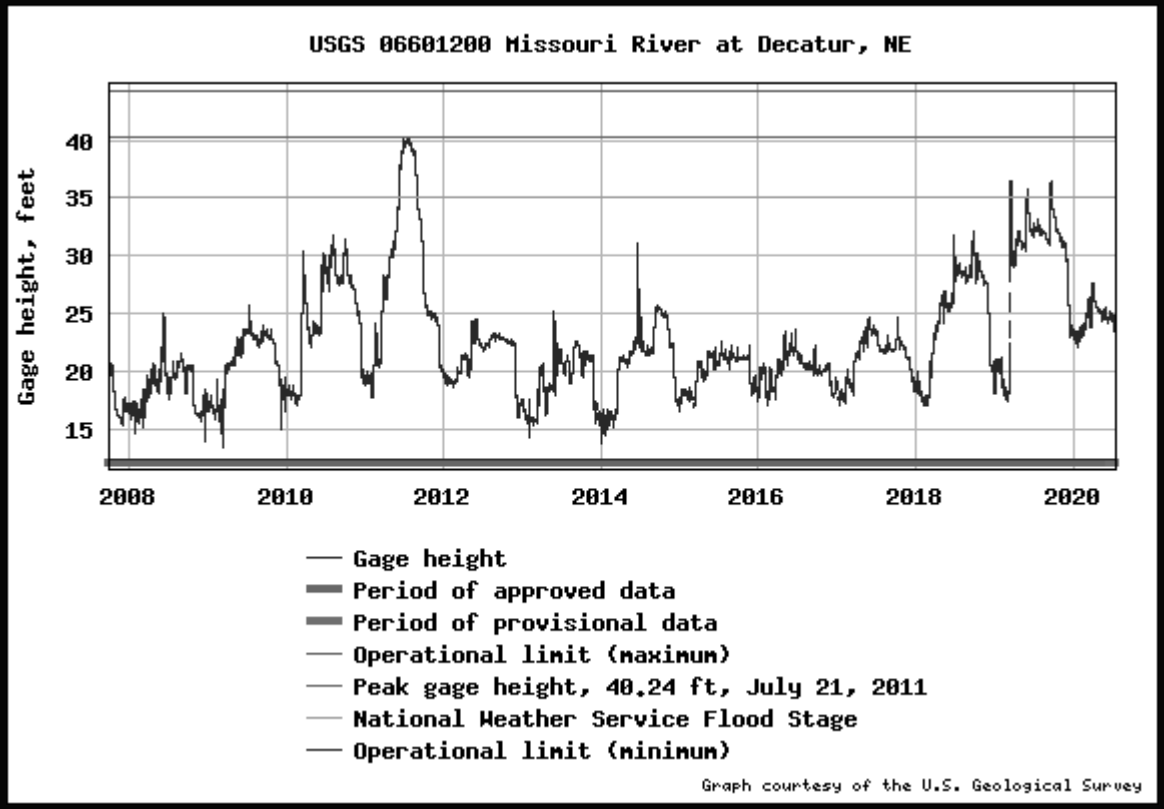
1. For the shallow groundwater contours, the estimated average gradient is 8.31E-04
   The maximum estimated grounwater velocity for the shallow groundwater is 3.32E-05 cm/sec. / 34.39 ft/year
   The minimum estimated groundwater velocity for the shallow groundwater is 5.54E-06 cm/sec. / 5.73 ft/year

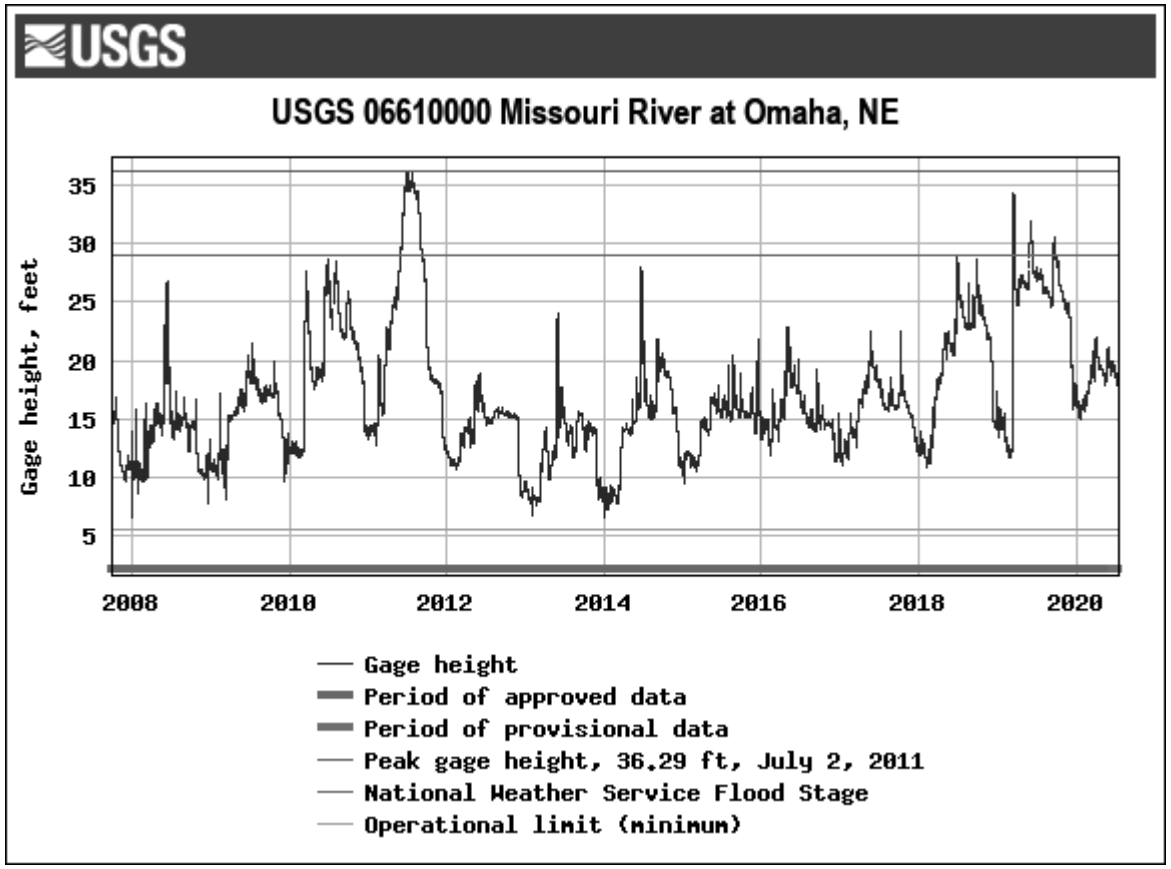
2. For the deep groundwater contours, the estimated average gradient is 8.49E-04
   The maximum estimated grounwater velocity for the deep groundwater is 3E-05 cm/sec. / 35.16 ft/year
   The minimum estimated groundwater velocity for the deep groundwater is 6E-06 cm/sec. / 5.86 ft/year

3. The magnitude of the vertical gradient for the multi-level wells ranges from approximately 0.0004 to 0.06, and the gradient direction is upwards for MW-1, MW-2, and MW-4. The gradient direction for MW-3 and MW-5 is downwards.

APPENDIX C

River Gauging Station Data Graphs


USGS 06601200 Missouri River at Decatur, NE
Gage height, feet
40
35
30
25
20
15
2008
2010
2012
2014
2016
2018
2020
Gage height
Period of approved data
Period of provisional data
Operational limit (maximum)
Peak gage height, 40.24 ft, July 21, 2011
National Weather Service Flood Stage
Operational limit (minimum)
Graph courtesy of the U.S. Geological Survey


USGS
USGS 06610000 Missouri River at Omaha, NE
Gage height, feet
35
30
25
20
15
10
5
2008
2010
2012
2014
2016
2018
2020
Gage height
Period of approved data
Period of provisional data
Peak gage height, 36.29 ft, July 2, 2011
National Weather Service Flood Stage
Operational limit (minimum)

APPENDIX D

Hydraulic Conductivity Analyses

HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

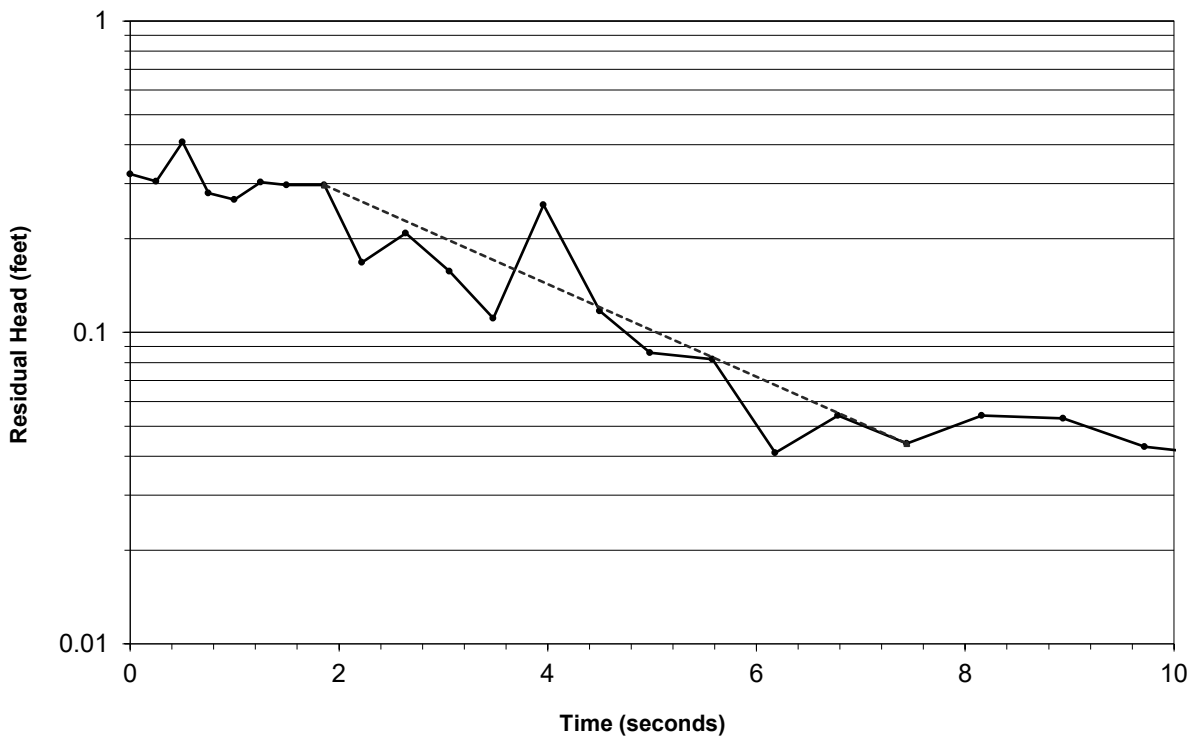
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	24	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	10.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	11	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.334	
For Lw=H - ln(Re/rw):	3.039	
Yo, in ft.:	0.30	
Yt, in ft.:	0.044	
t, in min.:	0.124	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	9.05E-03	
Kh (m/sec) =	9.05E-05	
Kh (ft/min) =	1.78E-02	
Kh (ft/day) =	2.57E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.322
0.25	0.31
0.5	0.41
0.75	0.28
1	0.27
1.25	0.30
1.5	0.30
1.86	0.30
2.22	0.17
2.64	0.21
3.06	0.16
3.48	0.11
3.96	0.26
4.5	0.12
4.98	0.09
5.58	0.08
6.18	0.04
6.78	0.05
7.44	0.04
8.16	0.05
8.94	0.05
9.72	0.04
10.56	0.04
11.46	0.01
12.42	0.02
13.38	0.02
14.46	0.00



HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-1A
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	24	
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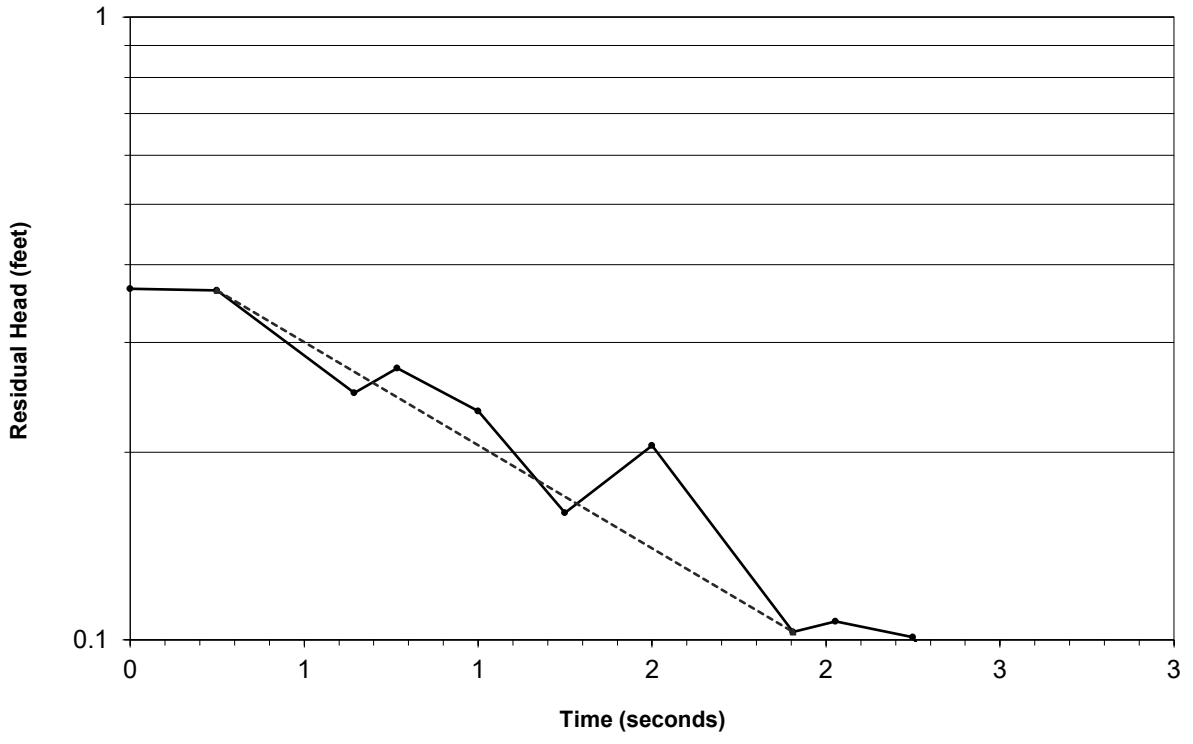
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	11	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.334	
For Lw=H - ln(Re/rw):	3.039	
Yo, in ft.:	0.36	
Yt, in ft.:	0.103	
t, in min.:	0.032	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	2.34E-02	
Kh (m/sec) =	2.34E-04	
Kh (ft/min) =	4.60E-02	
Kh (ft/day) =	6.62E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.366
0.25	0.36
0.644	0.25
0.768	0.27
1	0.23
1.25	0.16
1.5	0.21
1.905	0.10
2.028	0.11
2.25	0.10
2.5	0.06
2.75	0.09
3.047	0.04
3.25	0.04
3.5	0.06
3.75	0.04
4	0.04
4.25	0.04
4.5	0.03
4.86	0.02
5.22	0.04
5.64	0.03
6.06	0.01



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

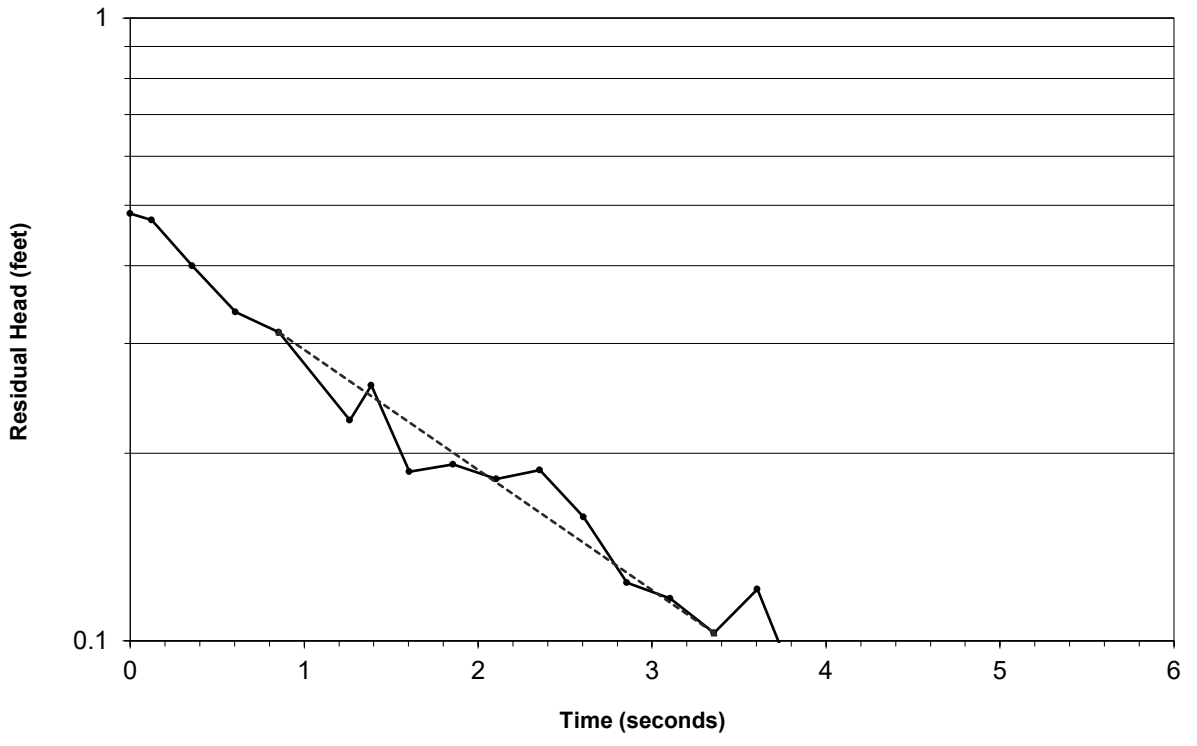
Monitoring Well ID:	MW-1A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	24	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	10.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	11	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.334	
For Lw=H - ln(Re/rw):	3.039	
Yo, in ft.:	0.31	
Yt, in ft.:	0.103	
t, in min.:	0.056	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.17E-02	
Kh (m/sec) =	1.17E-04	
Kh (ft/min) =	2.30E-02	
Kh (ft/day) =	3.31E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.485
0.125	0.47
0.356	0.40
0.606	0.34
0.856	0.31
1.262	0.23
1.386	0.26
1.606	0.19
1.856	0.19
2.106	0.18
2.356	0.19
2.606	0.16
2.856	0.12
3.106	0.12
3.356	0.10
3.606	0.12
3.856	0.08
4.216	0.09
4.576	0.06
4.996	0.05
5.416	0.06
5.836	0.05
6.316	0.07
6.856	0.04
7.336	0.03
7.936	0.02
8.536	0.05
9.136	0.04
9.796	0.02
10.516	0.02



HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-1A
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

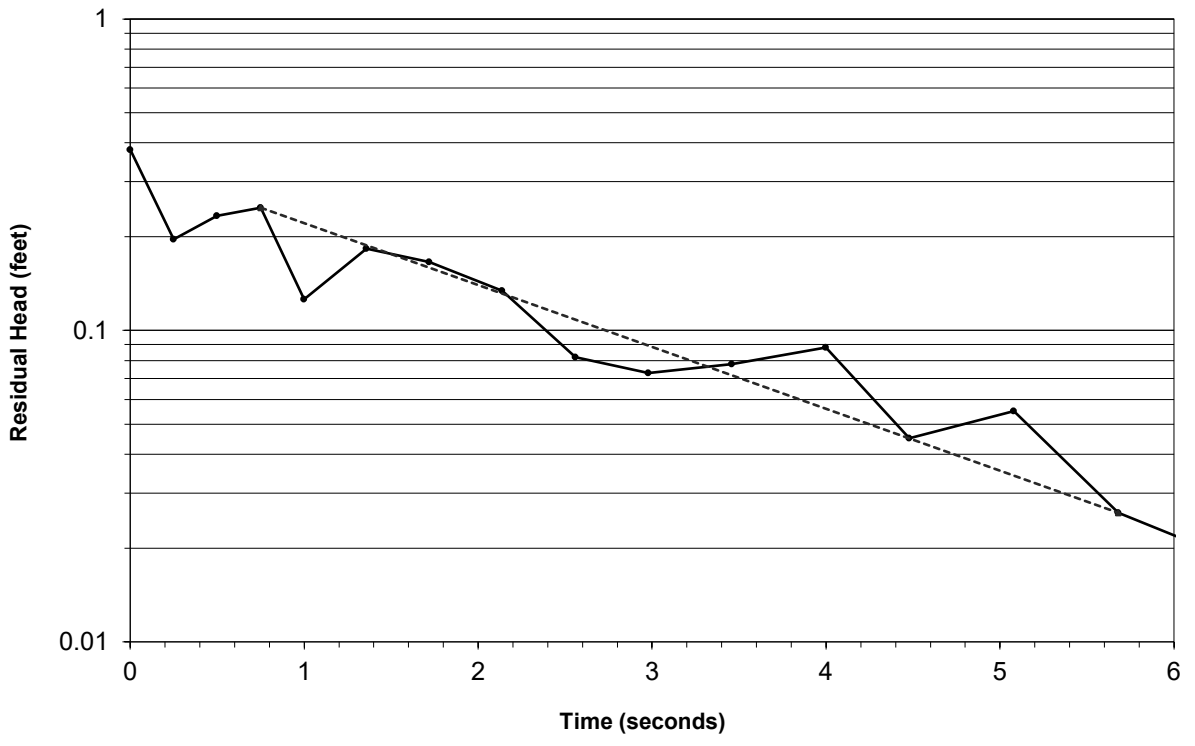
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	24	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	10.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	11	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.334	
For Lw=H - ln(Re/rw):	3.039	
Yo, in ft.:	0.25	
Yt, in ft.:	0.026	
t, in min.:	0.095	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.40E-02	
Kh (m/sec) =	1.40E-04	
Kh (ft/min) =	2.76E-02	
Kh (ft/day) =	3.97E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.38
0.25	0.20
0.5	0.23
0.75	0.25
1	0.13
1.359	0.18
1.72	0.17
2.139	0.13
2.56	0.08
2.979	0.07
3.46	0.08
3.999	0.09
4.479	0.04
5.079	0.05
5.68	0.03
6.279	0.02
6.939	0.03
7.659	0.04
8.439	0.03
9.219	0.02
10.059	0.01



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

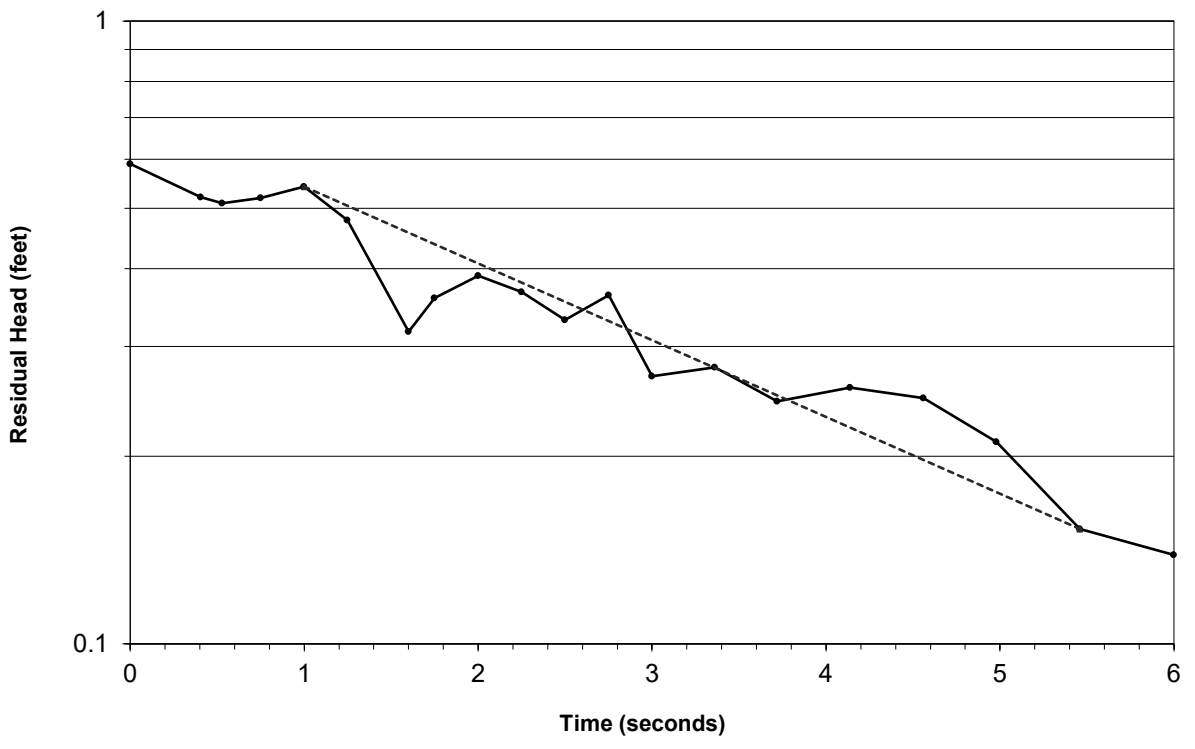
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	36.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.903	
For Lw=H - ln(Re/rw):	3.536	
Yo, in ft.:	0.54	
Yt, in ft.:	0.153	
t, in min.:	0.091	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.91E-02	
Kh (m/sec) =	1.91E-04	
Kh (ft/min) =	3.76E-02	
Kh (ft/day) =	5.42E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.589
0.406	0.52
0.529	0.51
0.75	0.52
1	0.54
1.25	0.48
1.6	0.32
1.75	0.36
2	0.39
2.25	0.37
2.5	0.33
2.75	0.36
3	0.27
3.36	0.28
3.72	0.24
4.14	0.26
4.56	0.25
4.98	0.21
5.46	0.15
6	0.14
6.48	0.14
7.08	0.15
7.68	0.12
8.28	0.09
8.94	0.08
9.66	0.05
10.44	0.06
11.22	0.05
12.06	0.07
12.96	0.06
13.92	0.04
14.88	0.08
15.96	0.01



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

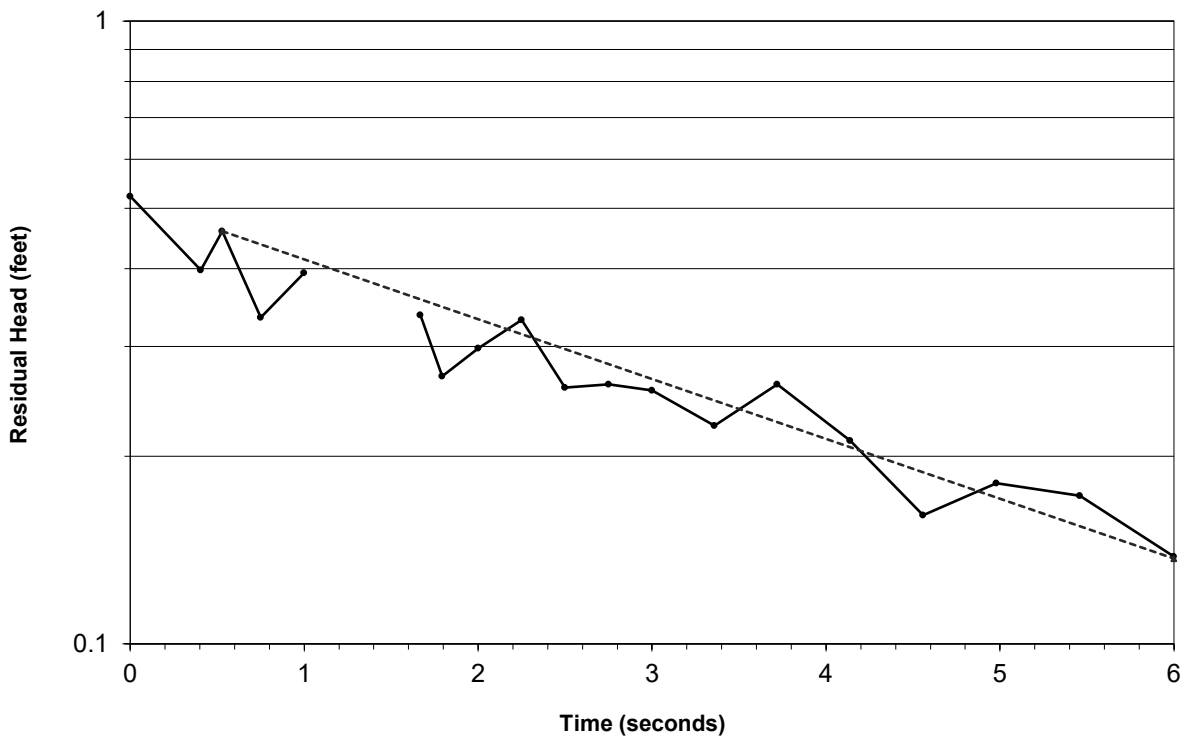
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	36.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.903	
For Lw=H - ln(Re/rw):	3.536	
Yo, in ft.:	0.46	
Yt, in ft.:	0.137	
t, in min.:	0.100	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.67E-02	
Kh (m/sec) =	1.67E-04	
Kh (ft/min) =	3.28E-02	
Kh (ft/day) =	4.72E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.523
0.405	0.40
0.529	0.46
0.75	0.33
1	0.39
1.669	0.34
1.793	0.27
2	0.30
2.25	0.33
2.5	0.26
2.75	0.26
3	0.25
3.359	0.22
3.72	0.26
4.139	0.21
4.559	0.16
4.979	0.18
5.46	0.17
5.999	0.14
6.479	0.12
7.079	0.09
7.68	0.09
8.279	0.06
8.939	0.06
9.659	0.05
10.439	0.03



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-1B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

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Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	36.99	
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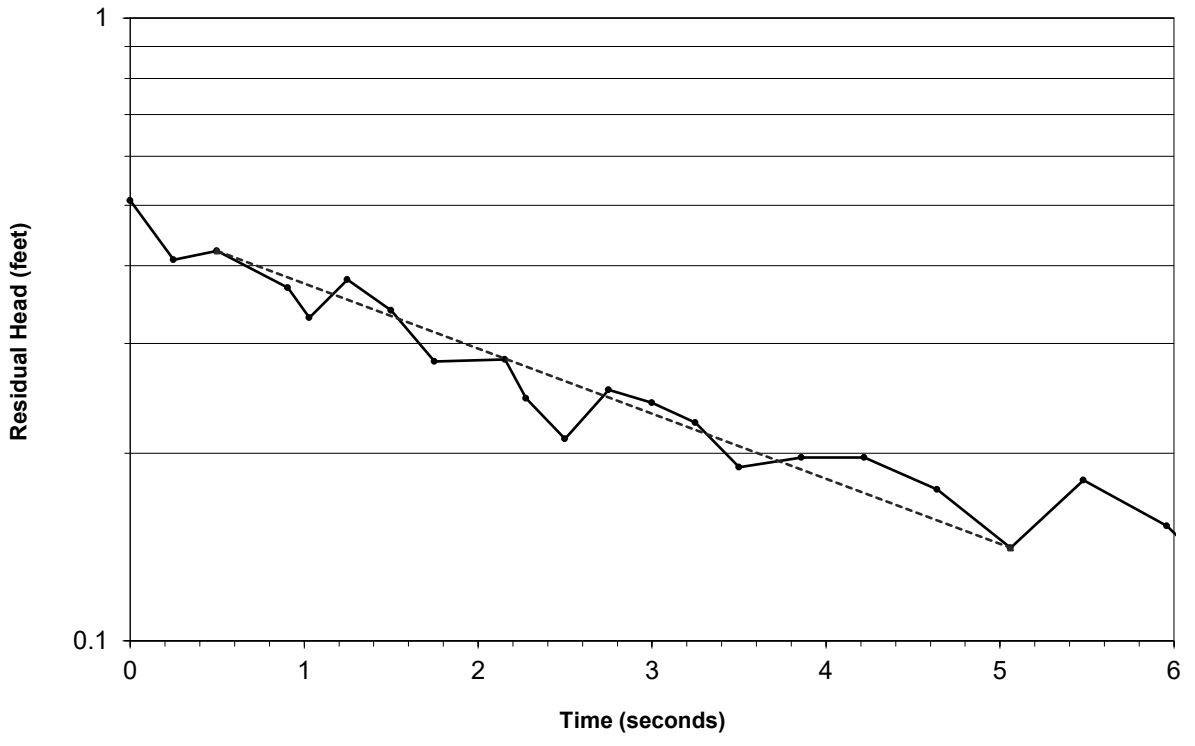
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.903	
For Lw=H - ln(Re/rw):	3.536	
Yo, in ft.:	0.42	
Yt, in ft.:	0.141	
t, in min.:	0.084	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.79E-02	
Kh (m/sec) =	1.79E-04	
Kh (ft/min) =	3.53E-02	
Kh (ft/day) =	5.08E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.509
0.25	0.41
0.5	0.42
0.907	0.37
1.031	0.33
1.25	0.38
1.5	0.34
1.75	0.28
2.154	0.28
2.277	0.25
2.5	0.21
2.75	0.25
3	0.24
3.25	0.22
3.5	0.19
3.86	0.20
4.22	0.20
4.64	0.18
5.06	0.14
5.48	0.18
5.96	0.15
6.5	0.11
6.98	0.09
7.58	0.08
8.18	0.06
8.78	0.04
9.44	0.09
10.16	0.04
10.94	0.03
11.72	0.02
12.56	0.03
13.46	0.10
14.42	0.00



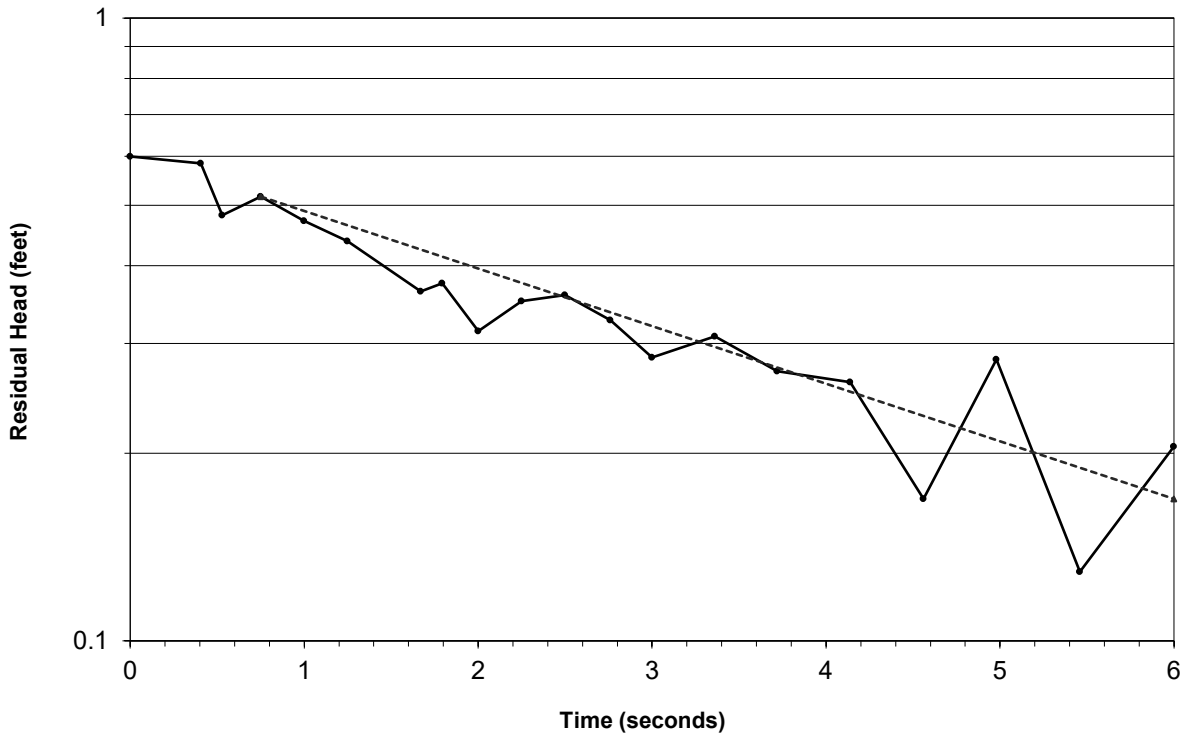
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-1B
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.01	
Well Depth-Static (Lw), in ft.:	36.99	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.903	
For Lw=H - ln(Re/rw):	3.536	
Yo, in ft.:	0.52	
Yt, in ft.:	0.169	
t, in min.:	0.100	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.54E-02	
Kh (m/sec) =	1.54E-04	
Kh (ft/min) =	3.03E-02	
Kh (ft/day) =	4.36E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.599
0.406	0.58
0.53	0.48
0.75	0.52
1	0.47
1.25	0.44
1.67	0.36
1.794	0.38
2	0.31
2.25	0.35
2.5	0.36
2.76	0.33
3	0.29
3.36	0.31
3.72	0.27
4.14	0.26
4.56	0.17
4.98	0.28
5.46	0.13
6	0.21
6.48	0.21
7.08	0.14
7.68	0.15
8.28	0.07
8.94	0.08
9.66	0.15
10.44	0.12
11.22	0.07
12.06	0.05
12.96	0.05
13.92	0.06
14.88	0.03
15.96	0.02



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-2
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

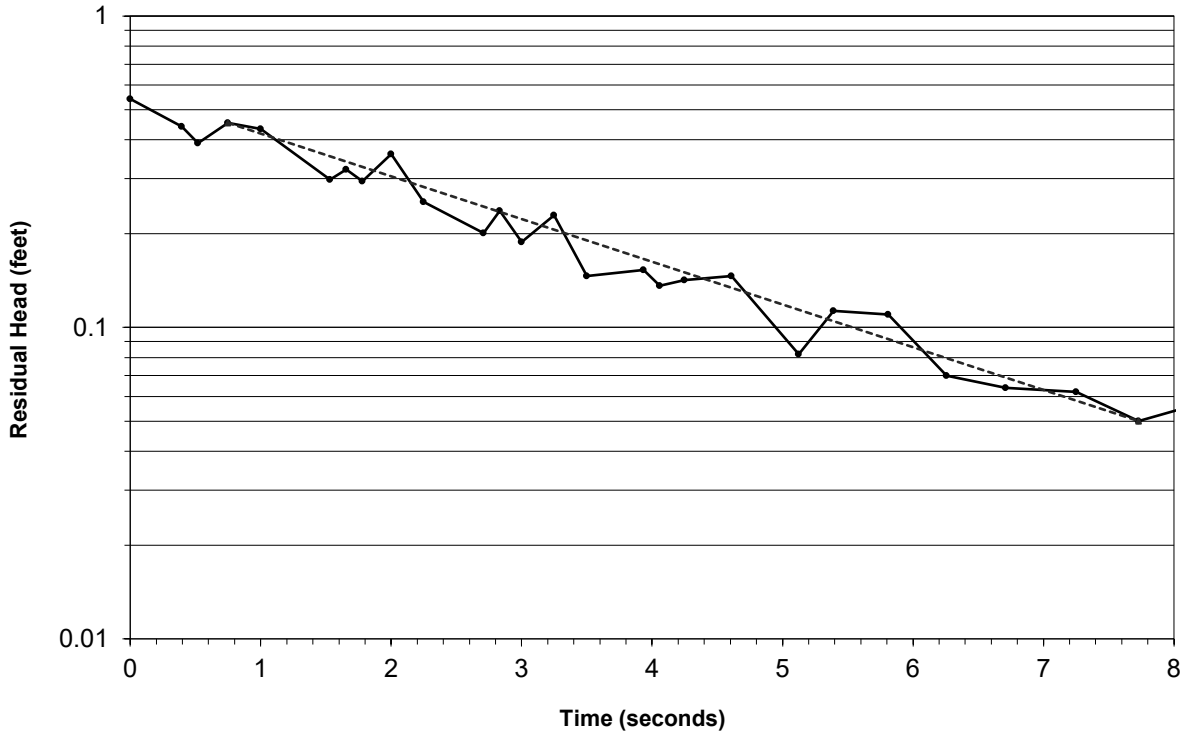
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.74	
Well Depth-Static (Lw), in ft.:	37.26	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.140	
For Lw=H - ln(Re/rw):	3.539	
Yo, in ft.:	0.45	
Yt, in ft.:	0.050	
t, in min.:	0.129	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.89E-02	
Kh (m/sec) =	1.89E-04	
Kh (ft/min) =	3.73E-02	
Kh (ft/day) =	5.37E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.542
0.394	0.44
0.519	0.39
0.75	0.45
1	0.43
1.532	0.30
1.656	0.32
1.781	0.30
2	0.36
2.25	0.25
2.708	0.20
2.832	0.24
3	0.19
3.25	0.23
3.5	0.15
3.936	0.15
4.06	0.14
4.25	0.14
4.61	0.15
5.124	0.08
5.39	0.11
5.81	0.11
6.257	0.07
6.71	0.06
7.25	0.06
7.73	0.05
8.33	0.06
8.93	0.02



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-2
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

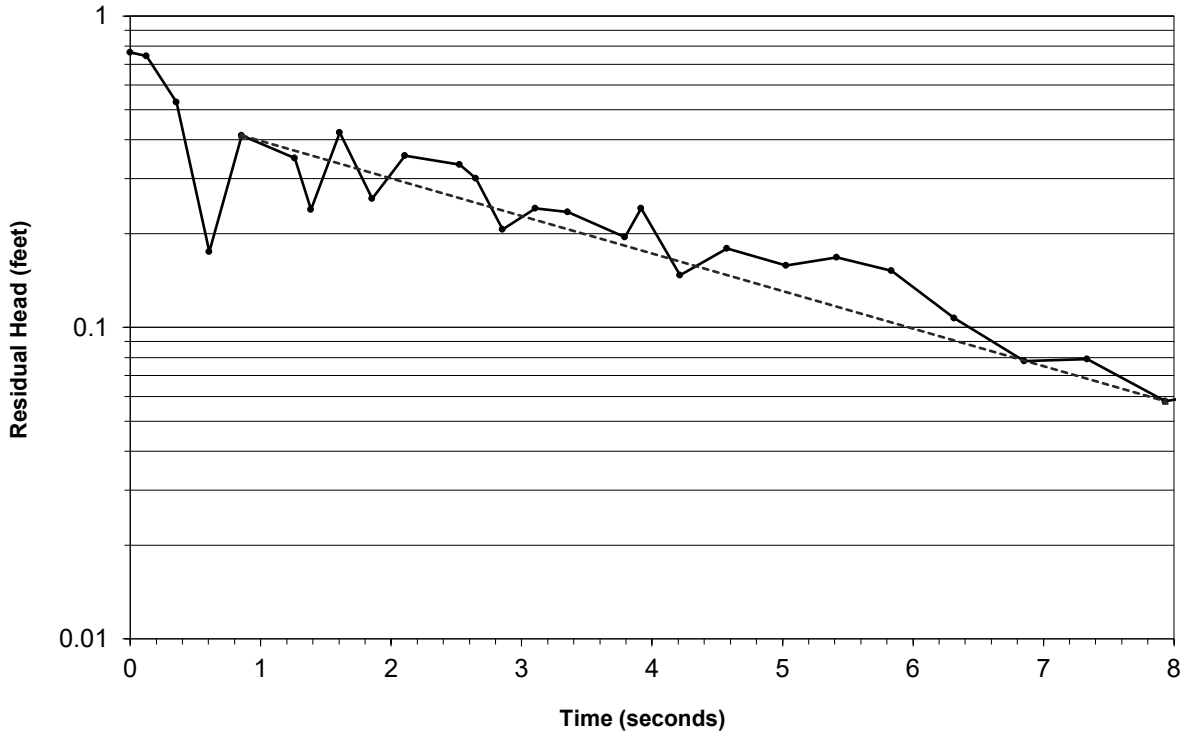
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.74	
Well Depth-Static (Lw), in ft.:	37.26	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.140	
For Lw=H - ln(Re/rw):	3.539	
Yo, in ft.:	0.41	
Yt, in ft.:	0.058	
t, in min.:	0.132	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.64E-02	
Kh (m/sec) =	1.64E-04	
Kh (ft/min) =	3.23E-02	
Kh (ft/day) =	4.66E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.764
0.125	0.74
0.355	0.53
0.605	0.18
0.855	0.41
1.261	0.35
1.385	0.24
1.605	0.42
1.855	0.26
2.105	0.36
2.525	0.33
2.65	0.30
2.855	0.21
3.105	0.24
3.355	0.24
3.791	0.20
3.915	0.24
4.215	0.15
4.575	0.18
5.028	0.16
5.415	0.17
5.835	0.15
6.315	0.11
6.855	0.08
7.335	0.08
7.935	0.06
8.535	0.06
9.135	0.08
9.795	0.02



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-2
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

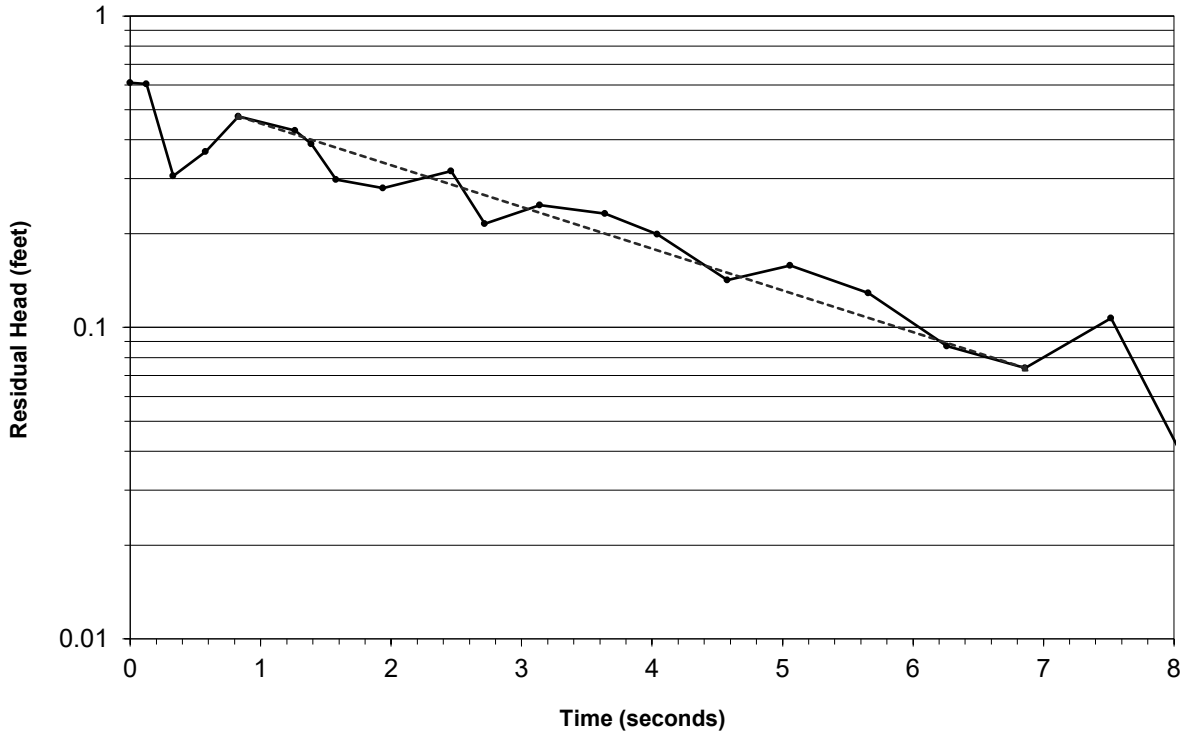
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.74	
Well Depth-Static (Lw), in ft.:	37.26	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.140	
For Lw=H - ln(Re/rw):	3.539	
Yo, in ft.:	0.48	
Yt, in ft.:	0.074	
t, in min.:	0.114	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.80E-02	
Kh (m/sec) =	1.80E-04	
Kh (ft/min) =	3.55E-02	
Kh (ft/day) =	5.11E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.611
0.124	0.60
0.329	0.31
0.579	0.37
0.829	0.48
1.265	0.43
1.388	0.39
1.579	0.30
1.939	0.28
2.46	0.32
2.719	0.22
3.139	0.25
3.64	0.23
4.039	0.20
4.579	0.14
5.059	0.16
5.659	0.13
6.259	0.09
6.859	0.07
7.519	0.11
8.239	0.03
9.019	0.06
9.799	0.04
10.639	0.04
11.539	0.03
12.499	0.01
13.459	0.02
14.539	0.00



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

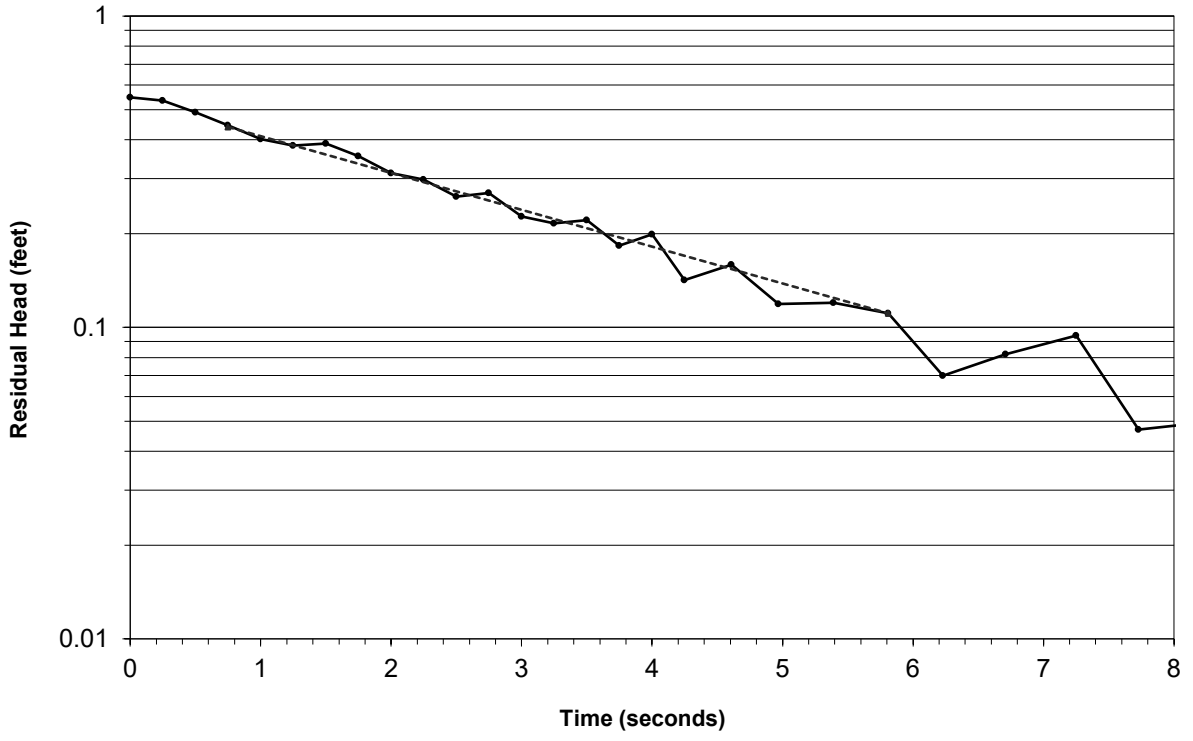
Monitoring Well ID:	MW-2
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.74	
Well Depth-Static (Lw), in ft.:	37.26	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.140	
For Lw=H - ln(Re/rw):	3.539	
Yo, in ft.:	0.44	
Yt, in ft.:	0.111	
t, in min.:	0.097	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.57E-02	
Kh (m/sec) =	1.57E-04	
Kh (ft/min) =	3.10E-02	
Kh (ft/day) =	4.46E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.547
0.25	0.53
0.5	0.49
0.75	0.44
1	0.40
1.25	0.38
1.5	0.39
1.75	0.35
2	0.31
2.25	0.30
2.5	0.26
2.75	0.27
3	0.23
3.25	0.22
3.5	0.22
3.75	0.18
4	0.20
4.25	0.14
4.61	0.16
4.97	0.12
5.39	0.12
5.81	0.11
6.23	0.07
6.71	0.08
7.25	0.09
7.73	0.05
8.33	0.05
8.93	0.08
9.53	0.01



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-3A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

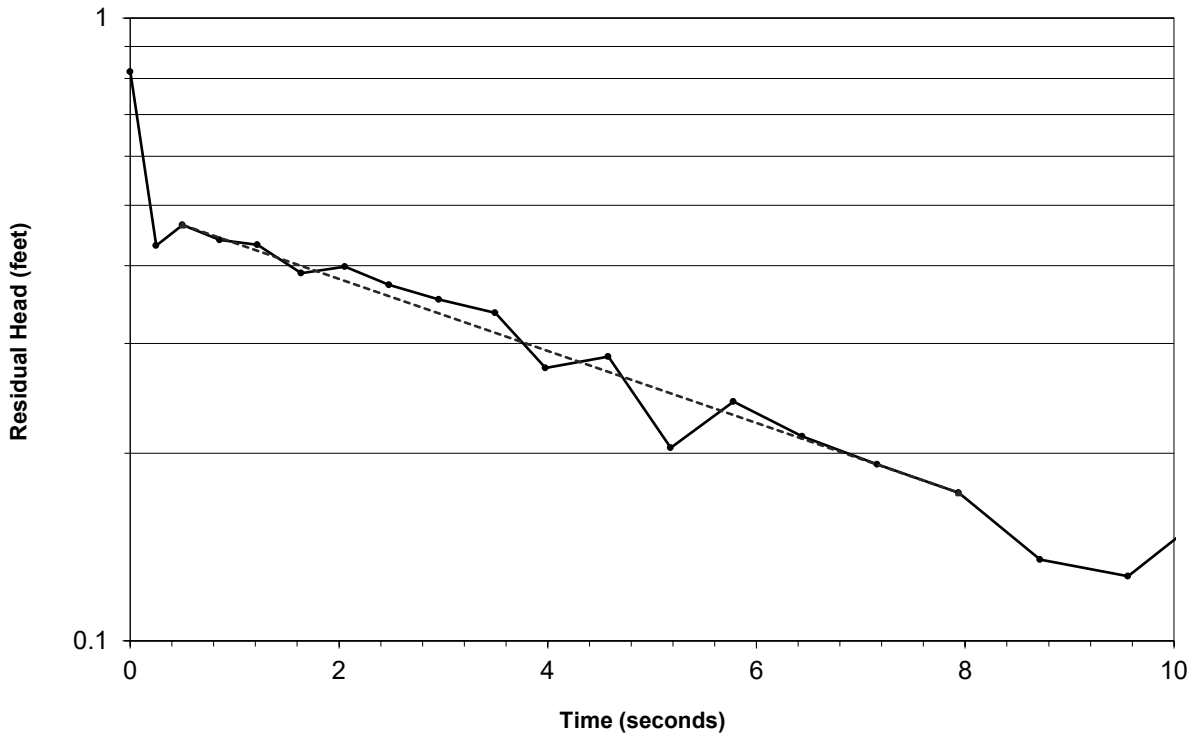
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	23	
Depth to Static (PVC) in ft.:	13.44	
Well Depth-Static (Lw), in ft.:	9.56	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.1241	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	9.56	
A:	3.101	
B:	0.526	
C:	3.039	
Le/rw:	50.987	
Saturated Thickness (H), in ft.:	10	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	2.862	
For Lw=H - ln(Re/rw):	2.946	
Yo, in ft.:	0.47	
Yt, in ft.:	0.173	
t, in min.:	0.132	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	8.75E-03	
Kh (m/sec) =	8.75E-05	
Kh (ft/min) =	1.72E-02	
Kh (ft/day) =	2.48E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.819
0.25	0.43
0.5	0.47
0.86	0.44
1.22	0.43
1.64	0.39
2.06	0.40
2.48	0.37
2.96	0.35
3.5	0.34
3.98	0.27
4.58	0.29
5.18	0.20
5.78	0.24
6.44	0.21
7.16	0.19
7.94	0.17
8.72	0.14
9.56	0.13
10.46	0.17
11.42	0.11
12.38	0.12
13.46	0.13
14.6	0.08
15.8	0.12
17.06	0.04
18.38	0.10
19.82	0.07
21.32	0.03
22.88	0.04
24.56	0.04
26.36	0.03
28.22	0.00



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-3A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

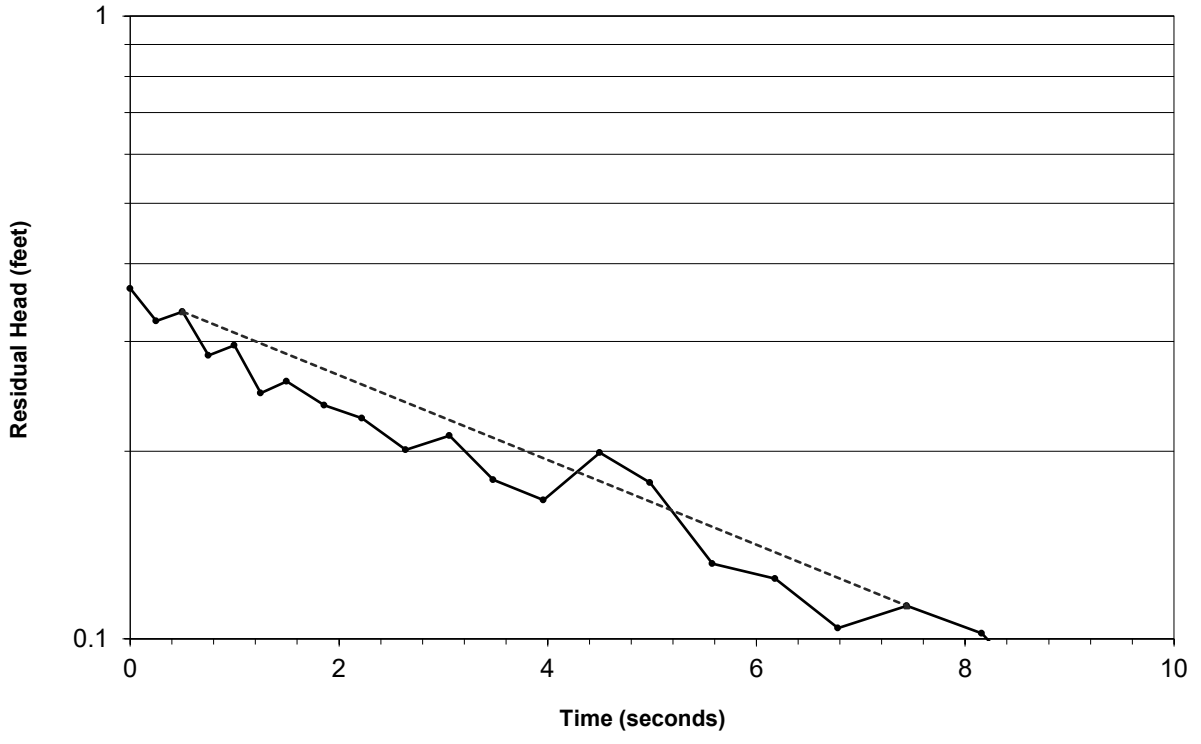
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	23	
Depth to Static (PVC) in ft.:	13.44	
Well Depth-Static (Lw), in ft.:	9.56	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.1241	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	9.56	
A:	3.101	
B:	0.526	
C:	3.039	
Le/rw:	50.987	
Saturated Thickness (H), in ft.:	10	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	2.862	
For Lw=H - ln(Re/rw):	2.946	
Yo, in ft.:	0.34	
Yt, in ft.:	0.113	
t, in min.:	0.124	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.03E-02	
Kh (m/sec) =	1.03E-04	
Kh (ft/min) =	2.02E-02	
Kh (ft/day) =	2.91E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.365
0.25	0.32
0.5	0.33
0.75	0.29
1	0.30
1.25	0.25
1.5	0.26
1.86	0.24
2.22	0.23
2.64	0.20
3.06	0.21
3.48	0.18
3.96	0.17
4.5	0.20
4.98	0.18
5.58	0.13
6.18	0.13
6.78	0.10
7.44	0.11
8.16	0.10
8.94	0.07
9.72	0.07
10.56	0.09
11.46	0.05
12.42	0.05
13.38	0.03
14.46	0.02
15.6	0.00



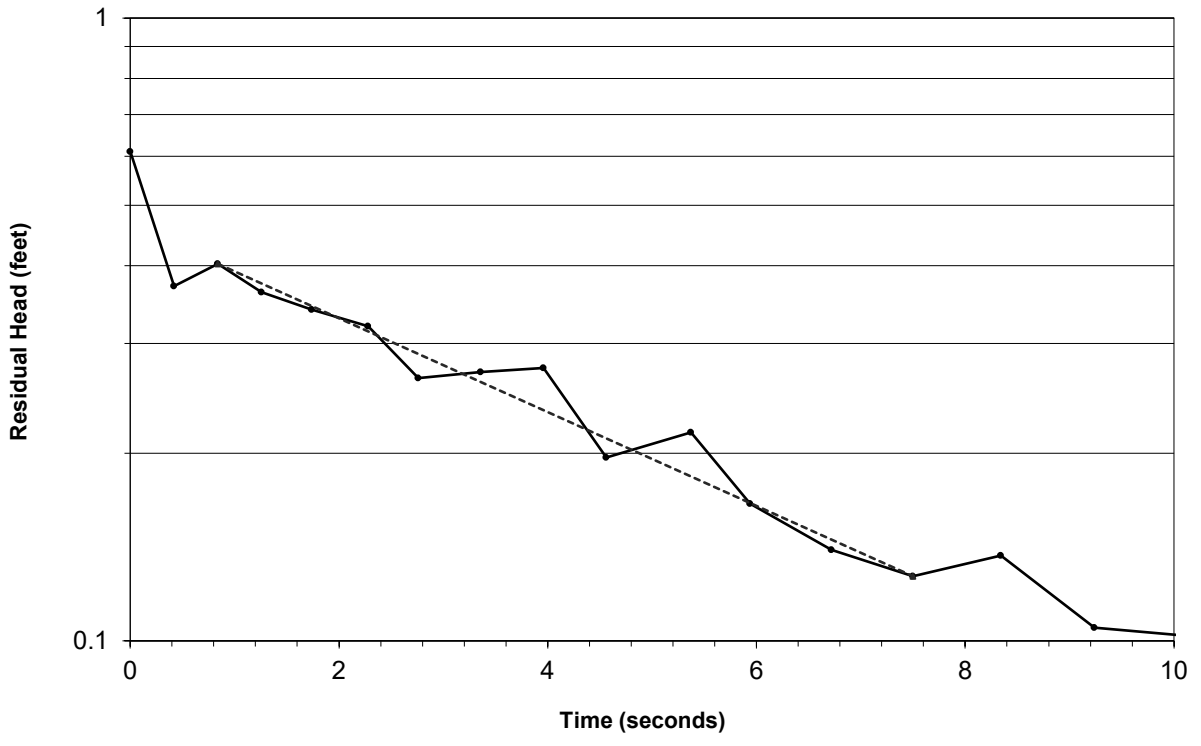
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-3A
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	23	
Depth to Static (PVC) in ft.:	13.44	
Well Depth-Static (Lw), in ft.:	9.56	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.1241	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	9.56	
A:	3.101	
B:	0.526	
C:	3.039	
Le/rw:	50.987	
Saturated Thickness (H), in ft.:	10	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	2.862	
For Lw=H - ln(Re/rw):	2.946	
Yo, in ft.:	0.40	
Yt, in ft.:	0.127	
t, in min.:	0.125	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.08E-02	
Kh (m/sec) =	1.08E-04	
Kh (ft/min) =	2.13E-02	
Kh (ft/day) =	3.07E+01	



Elapsed Time (sec)	Residual Head (ft.)
0	0.61
0.42	0.37
0.84	0.40
1.26	0.36
1.74	0.34
2.28	0.32
2.76	0.26
3.36	0.27
3.96	0.27
4.56	0.20
5.372	0.22
5.94	0.17
6.72	0.14
7.5	0.13
8.34	0.14
9.24	0.10
10.389	0.10
11.16	0.08
12.24	0.09
13.38	0.05
14.58	0.07
15.84	0.04
17.16	0.08
18.6	0.06
20.408	0.02
21.66	0.03
23.34	0.05
25.425	0.03
27	0.05
29.04	0.01
31.14	0.04
33.36	0.02
35.769	0.06
38.28	0.04
40.92	0.02
43.74	0.02
46.74	0.02
49.92	0.02
53.28	0.02
56.88	0.01
60.515	0.04
64.68	0.01
68.88	0.02
73.08	-0.01
77.88	-0.01
83.28	0.06
88.08	0.03
94.08	0.02
100.08	0.03
106.08	-0.01

HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-3A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

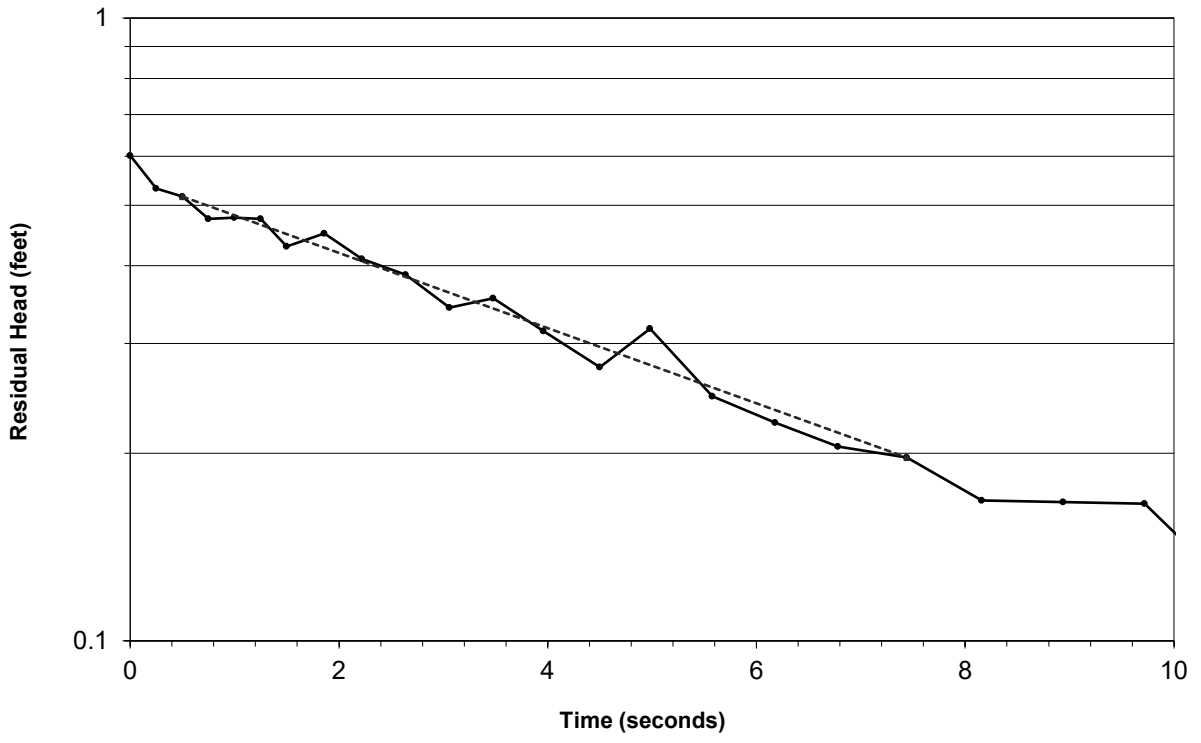
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	23	
Depth to Static (PVC) in ft.:	13.44	
Well Depth-Static (Lw), in ft.:	9.56	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.1241	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	9.56	
A:	3.101	
B:	0.526	
C:	3.039	
Le/rw:	50.987	
Saturated Thickness (H), in ft.:	10	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	2.862	
For Lw=H - ln(Re/rw):	2.946	
Yo, in ft.:	0.52	
Yt, in ft.:	0.197	
t, in min.:	0.124	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	9.11E-03	
Kh (m/sec) =	9.11E-05	
Kh (ft/min) =	1.79E-02	
Kh (ft/day) =	2.58E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.601
0.25	0.53
0.5	0.52
0.75	0.48
1	0.48
1.25	0.48
1.5	0.43
1.86	0.45
2.22	0.41
2.64	0.39
3.06	0.34
3.48	0.36
3.96	0.31
4.5	0.28
4.98	0.32
5.58	0.25
6.18	0.22
6.78	0.21
7.44	0.20
8.159	0.17
8.94	0.17
9.72	0.17
10.56	0.12
11.46	0.09
12.419	0.12
13.379	0.12
14.46	0.11
15.6	0.06
16.8	0.07
18.06	0.03
19.379	0.06
20.82	0.04
22.32	0.04
23.879	0.04
25.56	0.04
27.359	0.01



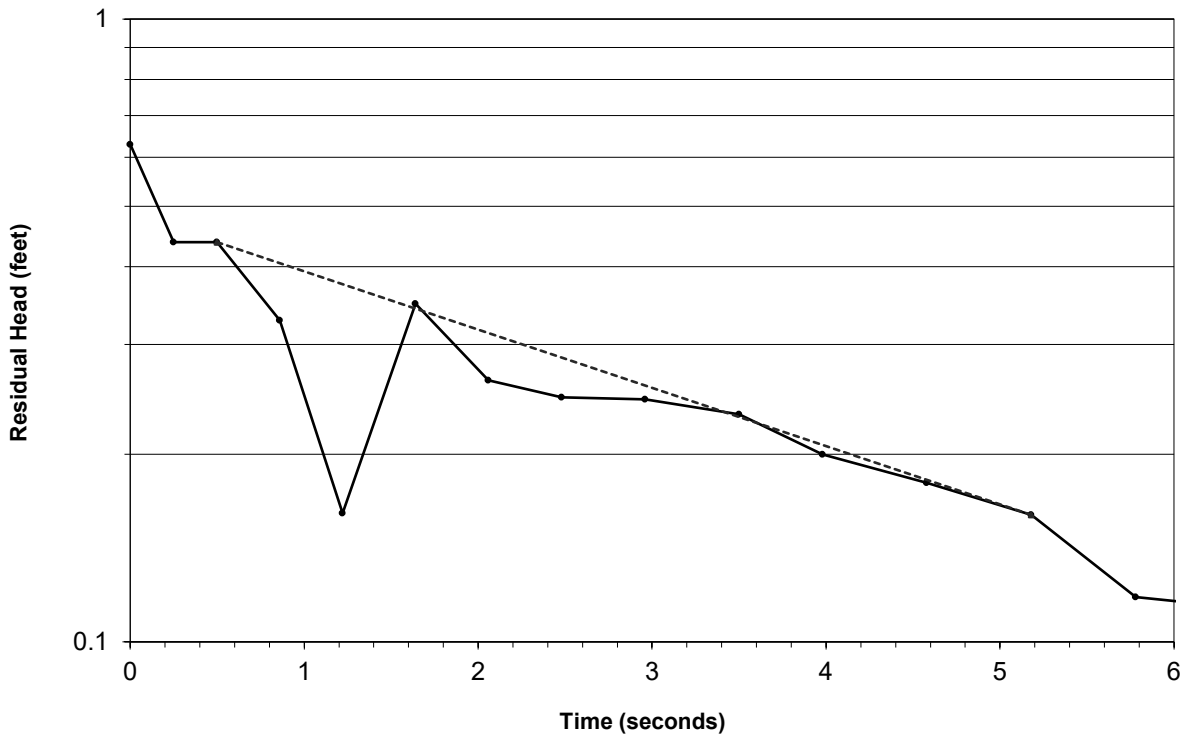
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-3B
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.42	
Well Depth-Static (Lw), in ft.:	36.58	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.216	
For Lw=H - ln(Re/rw):	3.530	
Yo, in ft.:	0.44	
Yt, in ft.:	0.160	
t, in min.:	0.086	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.32E-02	
Kh (m/sec) =	1.32E-04	
Kh (ft/min) =	2.60E-02	
Kh (ft/day) =	3.75E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.629
0.25	0.44
0.5	0.44
0.86	0.33
1.22	0.16
1.64	0.35
2.06	0.26
2.48	0.25
2.96	0.25
3.5	0.23
3.98	0.20
4.58	0.18
5.18	0.16
5.78	0.12
6.439	0.11
7.159	0.07
8.075	0.07
8.72	0.10
9.56	0.08
10.46	0.05
11.419	0.02
12.379	0.08
13.46	0.00



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-3B
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

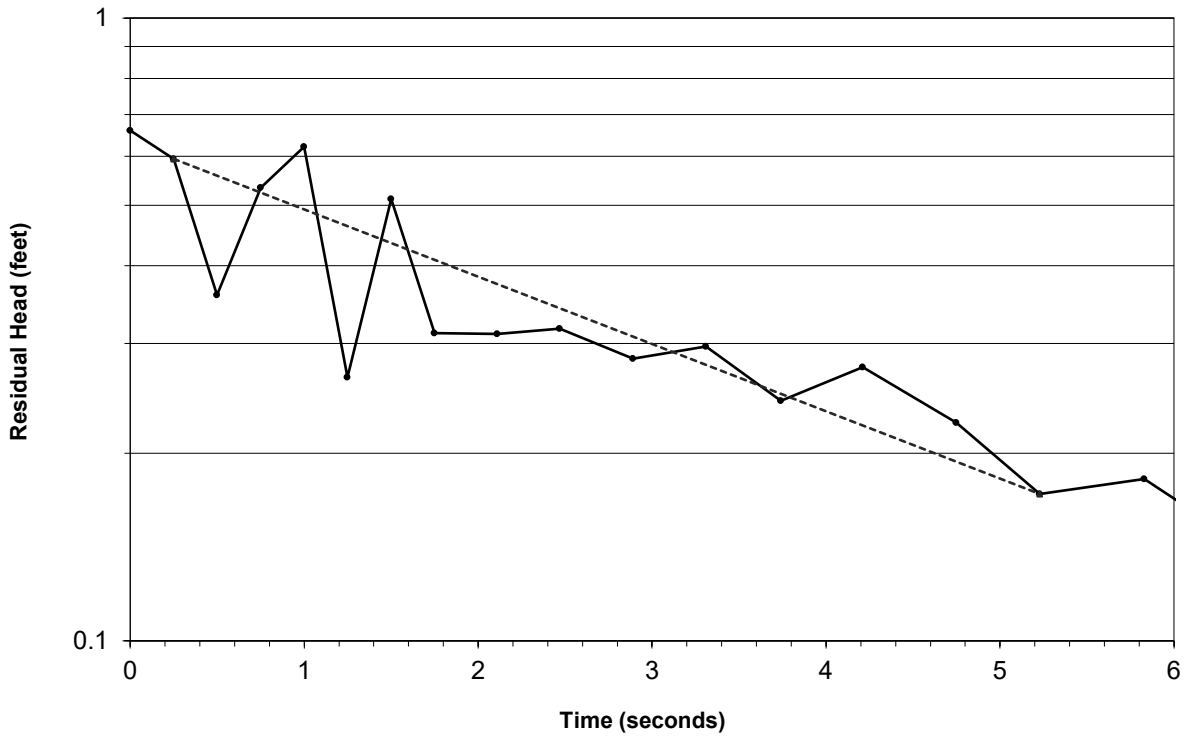
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.42	
Well Depth-Static (Lw), in ft.:	36.58	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.216	
For Lw=H - ln(Re/rw):	3.530	
Yo, in ft.:	0.59	
Yt, in ft.:	0.172	
t, in min.:	0.087	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.61E-02	
Kh (m/sec) =	1.61E-04	
Kh (ft/min) =	3.17E-02	
Kh (ft/day) =	4.57E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.659
0.25	0.59
0.5	0.36
0.75	0.53
1	0.62
1.25	0.26
1.5	0.51
1.75	0.31
2.11	0.31
2.47	0.32
2.89	0.28
3.309	0.30
3.741	0.24
4.21	0.27
4.749	0.22
5.229	0.17
5.829	0.18
6.43	0.14
7.029	0.09
7.689	0.11
8.409	0.06
9.189	0.07
9.969	0.07
10.809	0.04
11.71	0.05
12.669	0.04
13.629	0.02
14.71	0.03
15.849	0.05
17.049	0.02
18.309	0.00

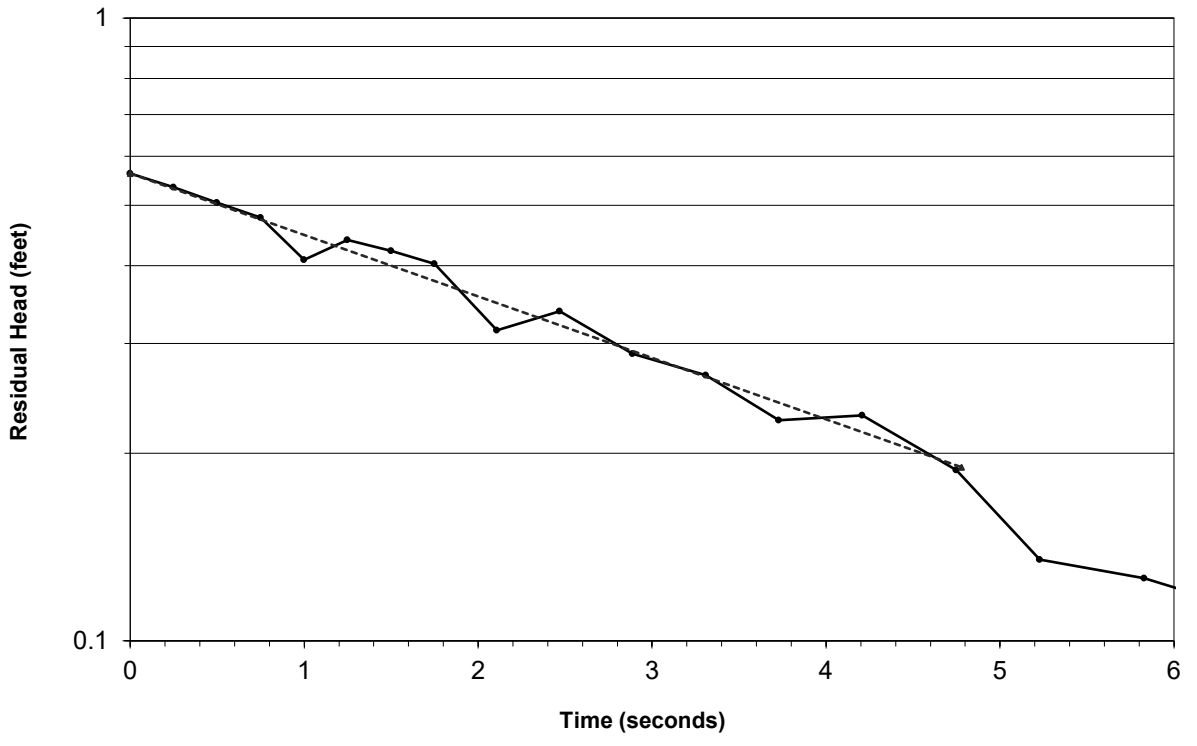


HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-3B
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.42	
Well Depth-Static (Lw), in ft.:	36.58	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.216	
For Lw=H - ln(Re/rw):	3.530	
Yo, in ft.:	0.56	
Yt, in ft.:	0.190	
t, in min.:	0.080	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.55E-02	
Kh (m/sec) =	1.55E-04	
Kh (ft/min) =	3.04E-02	
Kh (ft/day) =	4.38E+01	



Elapsed Time (sec)	Residual Head (ft.)
0	0.563
0.25	0.54
0.5	0.51
0.75	0.48
1	0.41
1.25	0.44
1.5	0.42
1.75	0.40
2.109	0.32
2.469	0.34
2.889	0.29
3.309	0.27
3.729	0.23
4.209	0.23
4.749	0.19
5.229	0.14
5.829	0.13
6.429	0.11
7.029	0.12
7.689	0.09
8.409	0.07
9.189	0.05
9.969	0.08
10.809	0.05
11.709	0.04
12.669	0.02
13.629	-0.01
14.709	0.03
15.849	0.02
17.049	0.05
18.309	0.00
19.629	0.02
21.069	0.00
22.569	0.00
24.129	0.02
25.809	0.04
27.609	0.02
29.469	0.02
31.509	-0.02
33.609	0.04
35.829	0.01
38.229	0.02
40.749	0.03
43.389	0.03
46.507	0.07
49.209	0.03
52.389	0.06
55.749	0.06
59.349	0.04
62.949	0.08

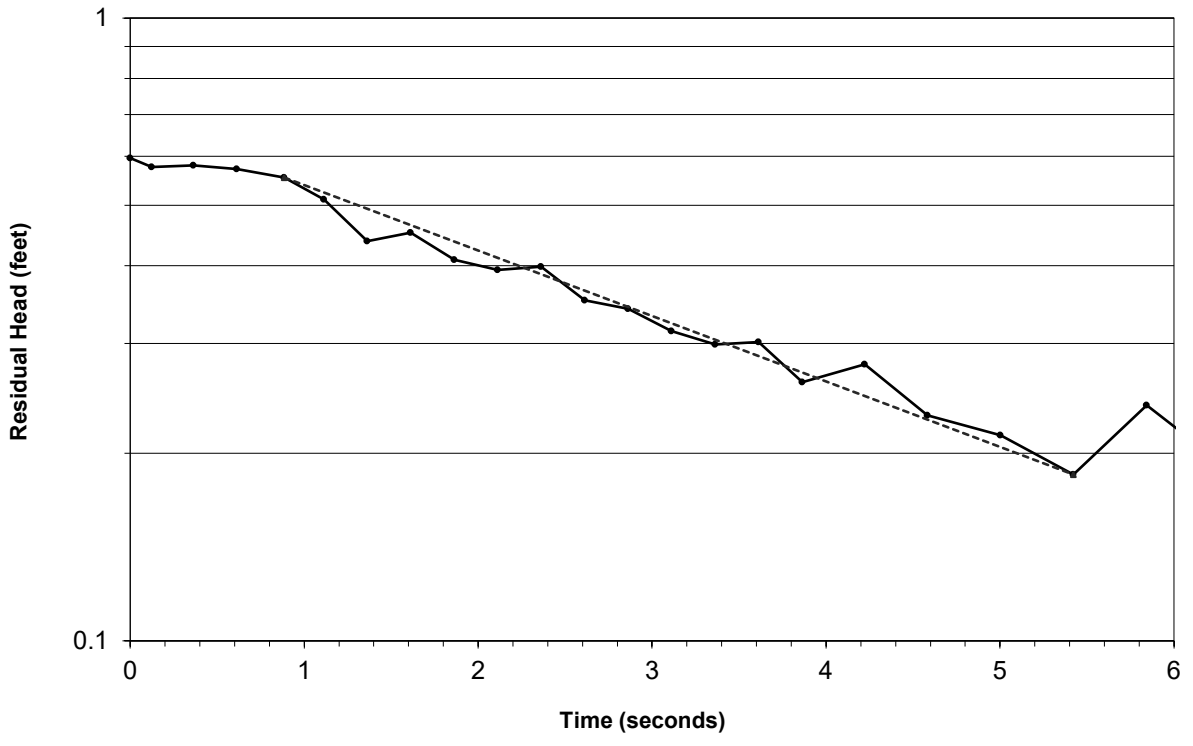
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-3B
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	13.42	
Well Depth-Static (Lw), in ft.:	36.58	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	37	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.216	
For Lw=H - ln(Re/rw):	3.530	
Yo, in ft.:	0.55	
Yt, in ft.:	0.185	
t, in min.:	0.090	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.38E-02	
Kh (m/sec) =	1.38E-04	
Kh (ft/min) =	2.71E-02	
Kh (ft/day) =	3.90E+01	



Elapsed Time (sec)	Residual Head (ft.)
0	0.596
0.125	0.58
0.363	0.58
0.613	0.57
0.885	0.55
1.113	0.51
1.363	0.44
1.613	0.45
1.863	0.41
2.113	0.39
2.363	0.40
2.613	0.35
2.863	0.34
3.113	0.31
3.363	0.30
3.613	0.30
3.863	0.26
4.223	0.28
4.583	0.23
5.003	0.21
5.423	0.19
5.843	0.24
6.323	0.19
6.863	0.17
7.343	0.18
7.943	0.18
8.543	0.13
9.143	0.15
9.803	0.11
10.523	0.12
11.303	0.12
12.083	0.11
12.923	0.10
13.823	0.13
14.783	0.10
15.743	0.11
16.823	0.08
17.963	0.08
19.163	0.09
20.423	0.08
21.743	0.10
23.183	0.10
24.683	0.13
26.243	0.07
27.923	0.11
29.723	0.12
31.583	0.13
33.623	0.15
35.723	0.09
37.943	0.10

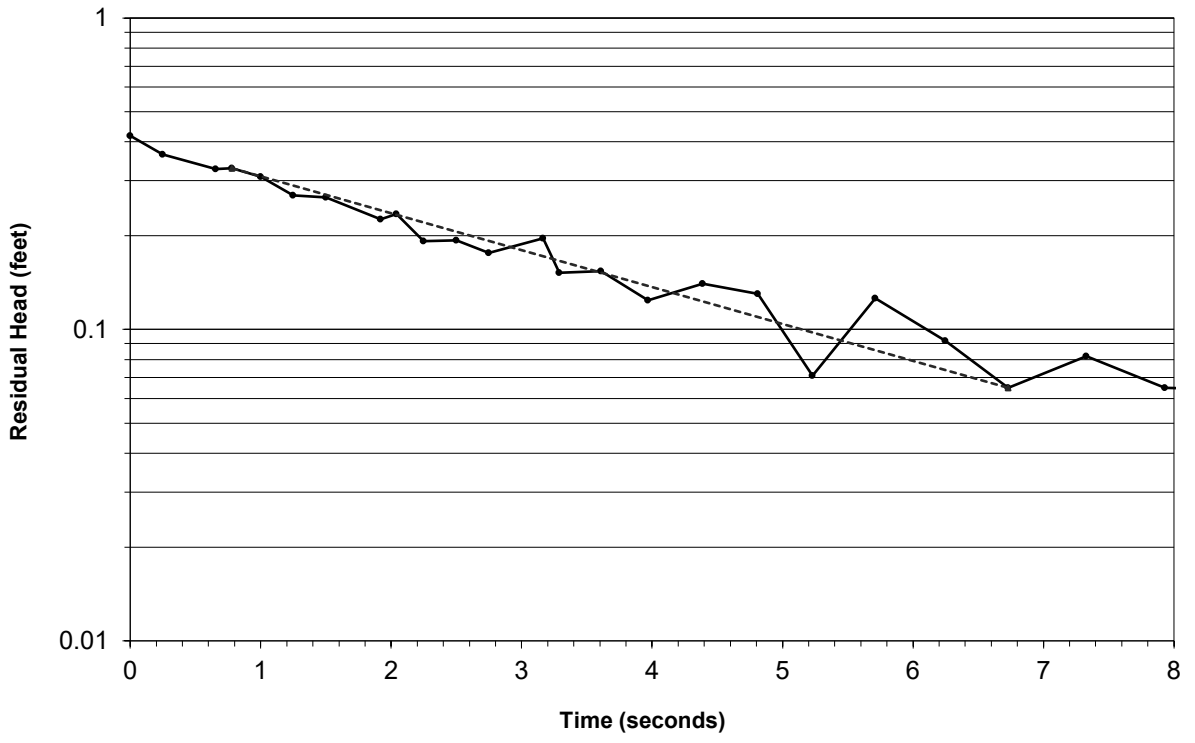
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-5A
Blair Nebraska	Test Date:	17-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.4	
Well Depth-Static (Lw), in ft.:	37.6	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.643	
For Lw=H - ln(Re/rw):	3.755	
Yo, in ft.:	0.33	
Yt, in ft.:	0.065	
t, in min.:	0.112	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	9.28E-03	
Kh (m/sec) =	9.28E-05	
Kh (ft/min) =	1.83E-02	
Kh (ft/day) =	2.63E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.418
0.25	0.36
0.657	0.33
0.78	0.33
1	0.31
1.25	0.27
1.5	0.26
1.919	0.23
2.042	0.23
2.25	0.19
2.5	0.19
2.75	0.18
3.165	0.20
3.289	0.15
3.609	0.15
3.97	0.12
4.389	0.14
4.809	0.13
5.229	0.07
5.71	0.13
6.249	0.09
6.729	0.06
7.329	0.08
7.93	0.06
8.529	0.06
9.189	0.02
9.909	0.05
10.689	0.05
11.469	0.04
12.309	0.06
13.209	0.02
14.169	0.03
15.129	-0.01



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

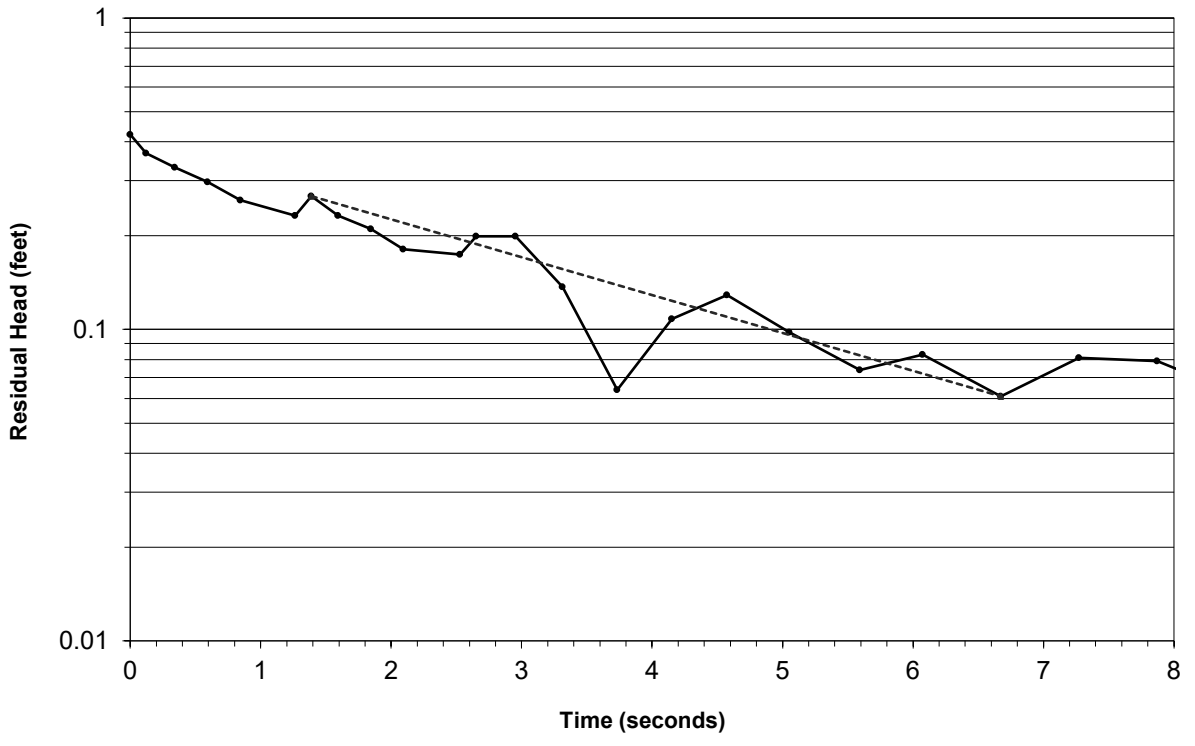
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.4	
Well Depth-Static (Lw), in ft.:	37.6	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.643	
For Lw=H - ln(Re/rw):	3.755	
Yo, in ft.:	0.27	
Yt, in ft.:	0.061	
t, in min.:	0.111	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	8.55E-03	
Kh (m/sec) =	8.55E-05	
Kh (ft/min) =	1.68E-02	
Kh (ft/day) =	2.42E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.422
0.123	0.37
0.344	0.33
0.594	0.30
0.844	0.26
1.265	0.23
1.388	0.27
1.594	0.23
1.844	0.21
2.094	0.18
2.529	0.17
2.652	0.20
2.953	0.20
3.314	0.14
3.733	0.06
4.153	0.11
4.573	0.13
5.054	0.10
5.593	0.07
6.073	0.08
6.673	0.06
7.274	0.08
7.873	0.08
8.533	0.06
9.254	0.05
10.033	0.03
10.813	0.02
11.653	0.02
12.553	0.06
13.513	0.01
14.474	0.01
15.553	0.05
16.693	0.02
17.893	0.00



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

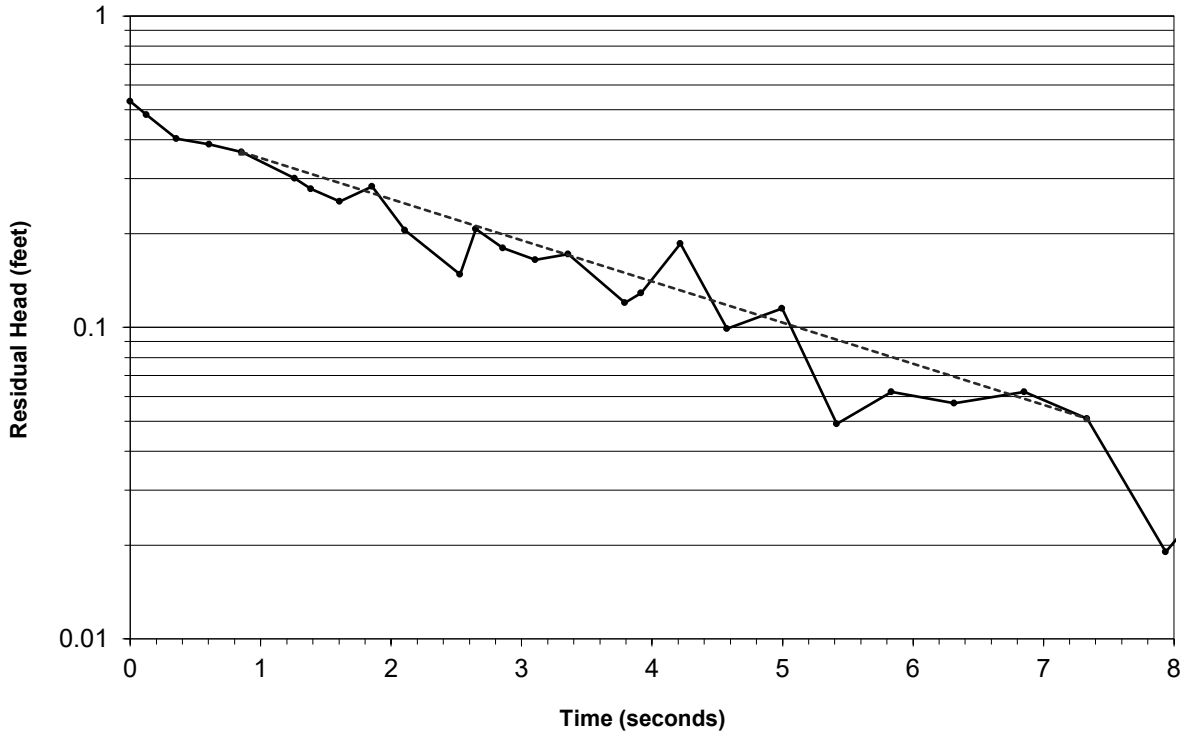
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.4	
Well Depth-Static (Lw), in ft.:	37.6	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.643	
For Lw=H - ln(Re/rw):	3.755	
Yo, in ft.:	0.37	
Yt, in ft.:	0.051	
t, in min.:	0.122	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.04E-02	
Kh (m/sec) =	1.04E-04	
Kh (ft/min) =	2.04E-02	
Kh (ft/day) =	2.93E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.532
0.125	0.48
0.356	0.40
0.606	0.39
0.856	0.37
1.263	0.30
1.387	0.28
1.606	0.25
1.856	0.28
2.106	0.21
2.527	0.15
2.65	0.21
2.856	0.18
3.106	0.17
3.356	0.17
3.792	0.12
3.915	0.13
4.216	0.19
4.576	0.10
4.996	0.12
5.416	0.05
5.835	0.06
6.316	0.06
6.855	0.06
7.335	0.05
7.936	0.02
8.536	0.04
9.136	0.01



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5A
Test Date:	17-Jun-20
H&A Rep.:	S. Kaney

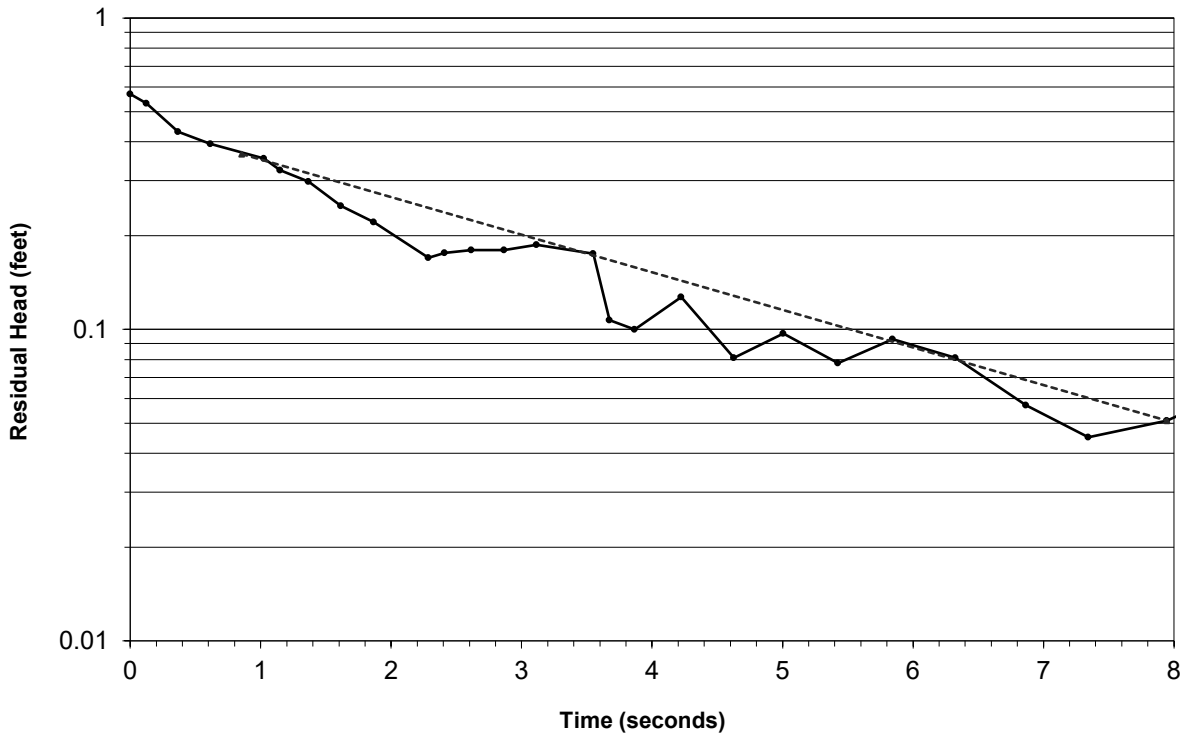
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.4	
Well Depth-Static (Lw), in ft.:	37.6	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	10.0	
Test Length Section (Le), in ft.:	10	
A:	3.164	
B:	0.538	
C:	3.136	
Le/rw:	53.333	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.643	
For Lw=H - ln(Re/rw):	3.755	
Yo, in ft.:	0.37	
Yt, in ft.:	0.051	
t, in min.:	0.132	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	9.56E-03	
Kh (m/sec) =	9.56E-05	
Kh (ft/min) =	1.88E-02	
Kh (ft/day) =	2.71E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.57
0.124	0.53
0.366	0.43
0.616	0.39
1.024	0.35
1.149	0.32
1.366	0.30
1.616	0.25
1.866	0.22
2.287	0.17
2.411	0.18
2.616	0.18
2.866	0.18
3.116	0.19
3.551	0.18
3.675	0.11
3.866	0.10
4.225	0.13
4.627	0.08
5.005	0.10
5.425	0.08
5.845	0.09
6.326	0.08
6.865	0.06
7.345	0.04
7.945	0.05
8.545	0.07
9.145	0.02
9.805	0.01
10.525	0.03
11.305	0.00



HALEY & ALDRICH, INC
Fort Calhoun Station
Blair Nebraska
127960-006

FALLING HEAD TEST SUMMARY

Monitoring Well ID:	MW-5B
Test Date:	18-Jun-20
H&A Rep.:	S. Kaney

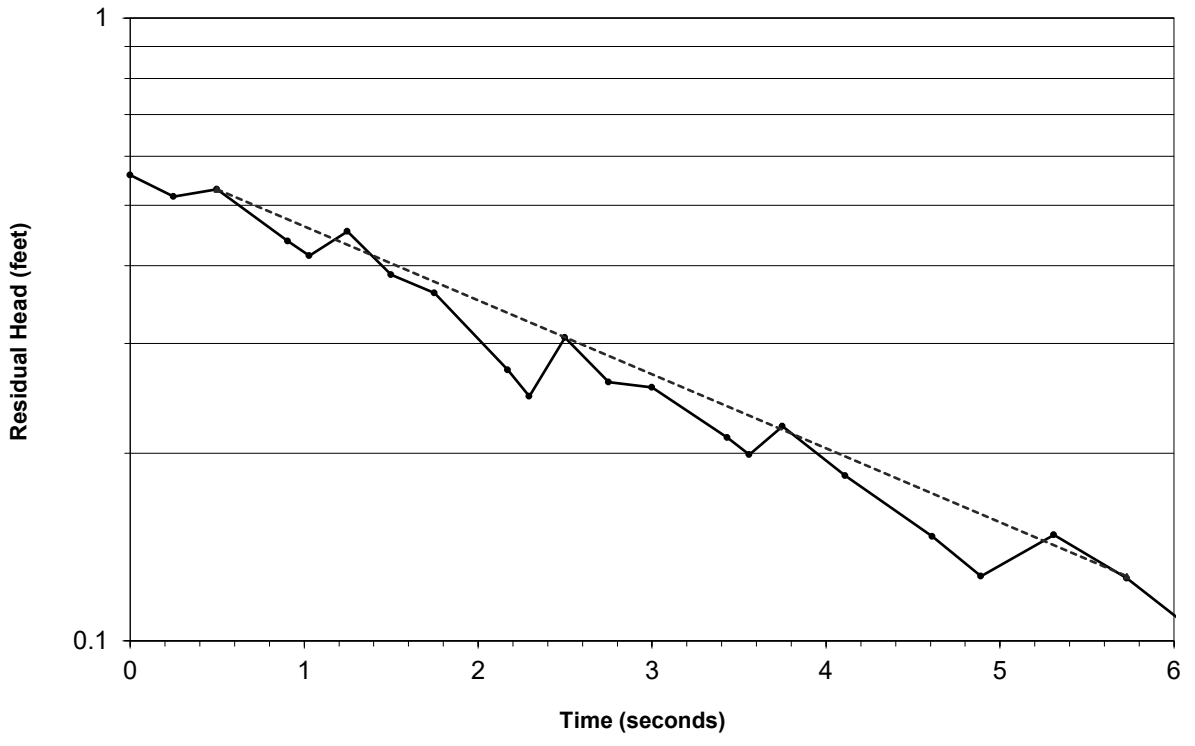
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.22	
Well Depth-Static (Lw), in ft.:	37.78	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.330	
For Lw=H - ln(Re/rw):	3.546	
Yo, in ft.:	0.53	
Yt, in ft.:	0.127	
t, in min.:	0.096	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.76E-02	
Kh (m/sec) =	1.76E-04	
Kh (ft/min) =	3.46E-02	
Kh (ft/day) =	4.98E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.559
0.25	0.52
0.5	0.53
0.906	0.44
1.03	0.41
1.25	0.45
1.5	0.39
1.75	0.36
2.172	0.27
2.295	0.25
2.5	0.31
2.75	0.26
3	0.25
3.434	0.21
3.558	0.20
3.75	0.22
4.11	0.18
4.611	0.15
4.89	0.13
5.31	0.15
5.73	0.13
6.21	0.10
6.75	0.09
7.23	0.10
7.83	0.05
8.43	0.08
9.03	0.07
9.69	0.04
10.41	-0.01
11.19	0.02
11.97	0.05
12.81	-0.01
13.71	0.00



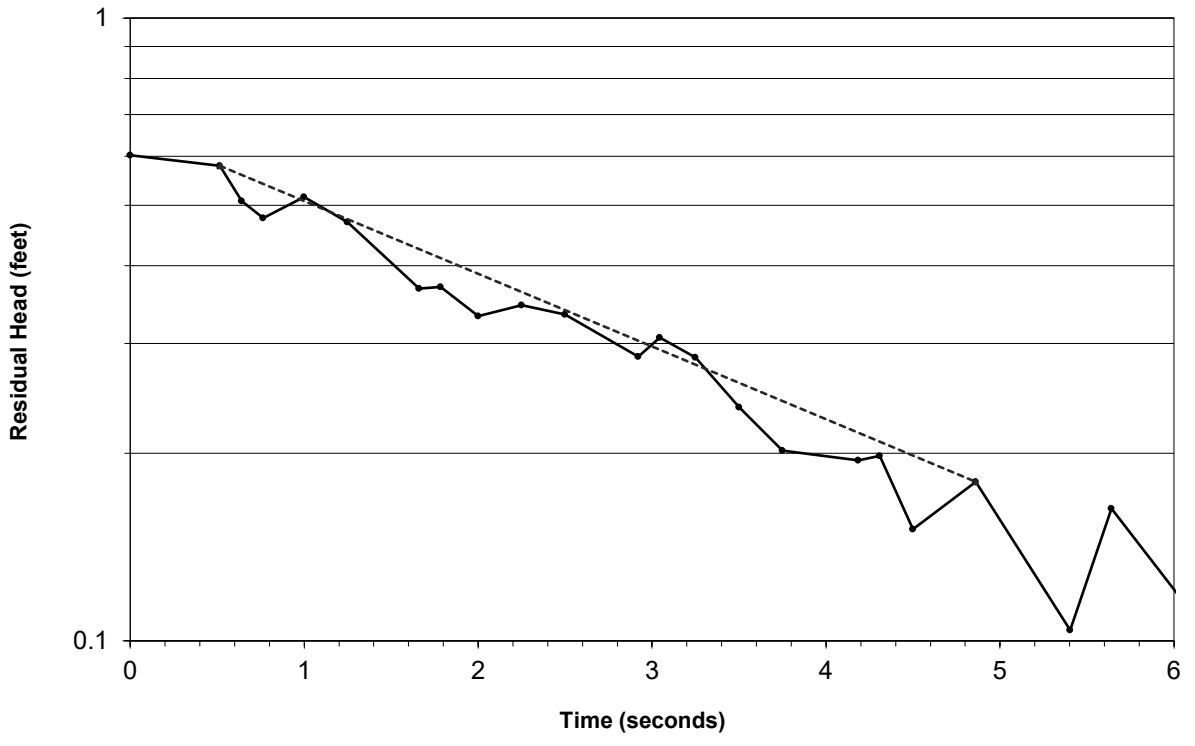
HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-5B
Blair Nebraska	Test Date:	18-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.22	
Well Depth-Static (Lw), in ft.:	37.78	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.330	
For Lw=H - ln(Re/rw):	3.546	
Yo, in ft.:	0.58	
Yt, in ft.:	0.180	
t, in min.:	0.081	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.69E-02	
Kh (m/sec) =	1.69E-04	
Kh (ft/min) =	3.33E-02	
Kh (ft/day) =	4.80E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.602
0.516	0.58
0.64	0.51
0.765	0.48
1	0.52
1.25	0.47
1.66	0.37
1.785	0.37
2	0.33
2.25	0.35
2.5	0.33
2.92	0.29
3.044	0.31
3.25	0.29
3.5	0.24
3.75	0.20
4.185	0.20
4.308	0.20
4.5	0.15
4.86	0.18
5.403	0.10
5.64	0.16
6.06	0.11
6.48	0.14
6.96	0.08
7.5	0.07
7.98	0.09
8.58	0.06
9.18	0.08
9.78	0.06
10.44	0.04
11.16	0.00
11.94	0.04
12.72	0.00
13.56	0.03
14.46	0.04
15.42	-0.01
16.379	0.00

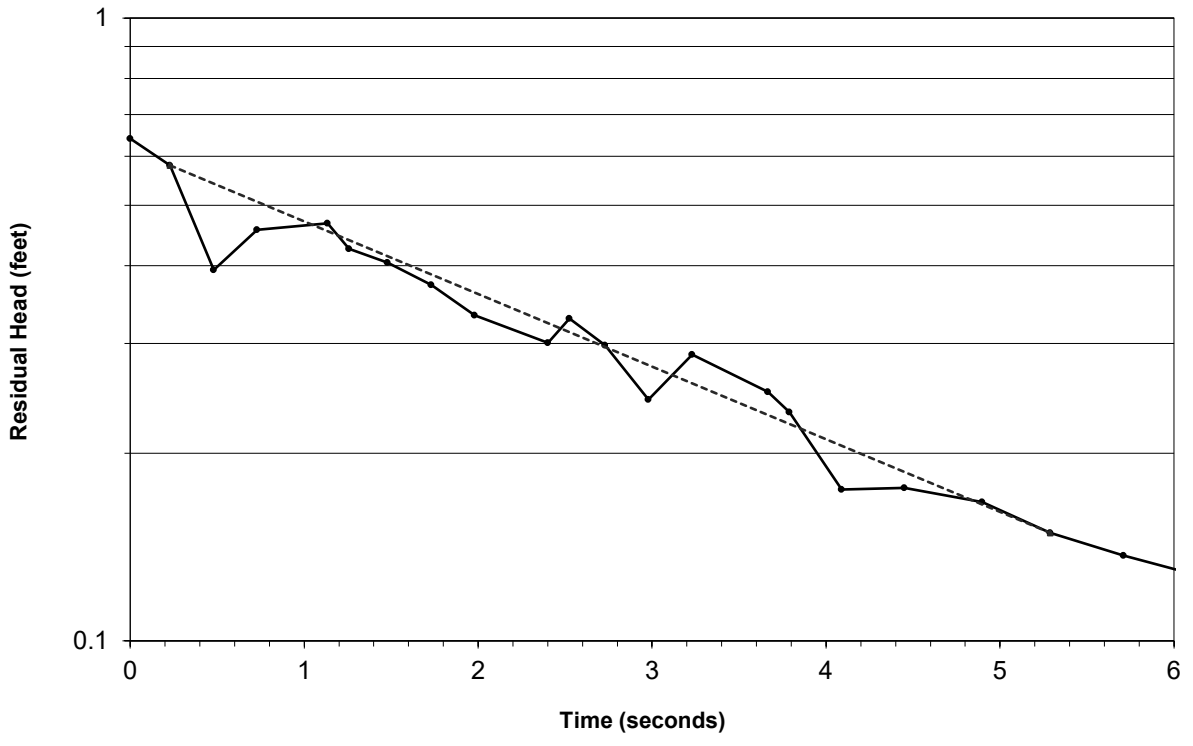


HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-5B
Blair Nebraska	Test Date:	18-Jun-20
127960-006	H&A Rep.:	S. Kaney

TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.22	
Well Depth-Static (Lw), in ft.:	37.78	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.330	
For Lw=H - ln(Re/rw):	3.546	
Yo, in ft.:	0.58	
Yt, in ft.:	0.149	
t, in min.:	0.088	
	(Lw<H)	(Lw=H)
Kh (cm/sec) =	1.81E-02	
Kh (m/sec) =	1.81E-04	
Kh (ft/min) =	3.56E-02	
Kh (ft/day) =	5.13E+01	



Elapsed Time (sec)	Residual Head (ft.)
0	0.64
0.23	0.58
0.48	0.39
0.73	0.46
1.135	0.47
1.259	0.43
1.48	0.41
1.73	0.37
1.98	0.33
2.401	0.30
2.525	0.33
2.73	0.30
2.98	0.24
3.23	0.29
3.665	0.25
3.789	0.23
4.09	0.18
4.45	0.18
4.899	0.17
5.29	0.15
5.71	0.14
6.251	0.13
6.73	0.09
7.21	0.06
7.81	0.08
8.41	0.03
9.01	0.05
9.669	0.03
10.389	0.03
11.169	0.03
11.949	0.04
12.79	0.02
14.69	0.02
14.815	0.02
15.609	0.02
17.69	0.00
17.83	-0.01
19.03	-0.04
20.29	0.01
21.609	-0.02
23.05	-0.04
24.55	-0.02
26.109	0.02
27.79	0.01
29.589	0.01
31.449	-0.01
33.49	0.03
35.589	0.00
37.809	-0.01
40.21	-0.05

HALEY & ALDRICH, INC	**FALLING HEAD TEST SUMMARY**	
Fort Calhoun Station	Monitoring Well ID:	MW-5B
Blair Nebraska	Test Date:	18-Jun-20
127960-006	H&A Rep.:	S. Kaney

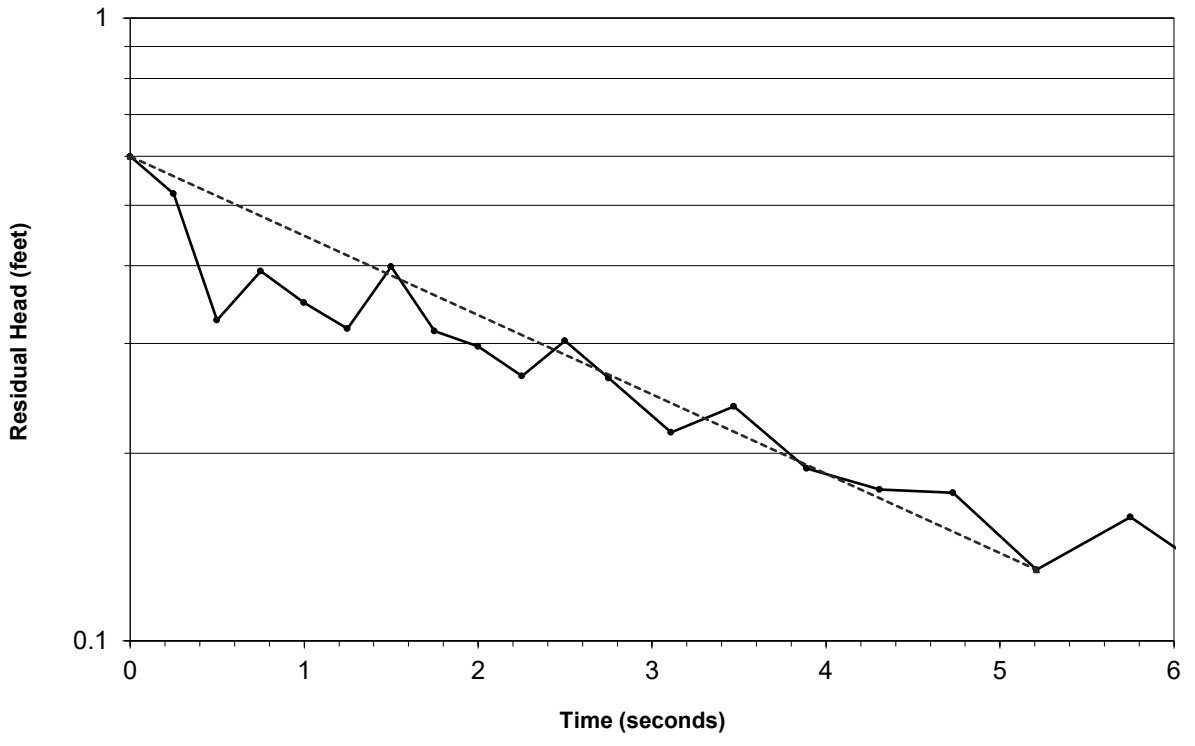
TEST WELL

Falling Head Permeability Calculation: Bouwer-Rice Method

Well Depth (PVC), in ft.:	50	
Depth to Static (PVC) in ft.:	12.22	
Well Depth-Static (Lw), in ft.:	37.78	
Test Section Radius (rw), in ft.:	0.188	
Nominal Casing Radius (rc), in ft.:	0.083	
Equivalent Casing Radius (rc') in ft:	0.0833	(Adjust for water-table wells only)
Nominal Screen Length in ft:	5.0	
Test Length Section (Le), in ft.:	5	
A:	2.418	
B:	0.387	
C:	1.991	
Le/rw:	26.667	
Saturated Thickness (H), in ft.:	38	(Water table elev - aquifer bottom elev)
		(Note: H must be >= LW)
For Lw<H - ln(Re/rw):	3.330	
For Lw=H - ln(Re/rw):	3.546	
Yo, in ft.:	0.60	
Yt, in ft.:	0.130	
t, in min.:	0.087	

	(Lw<H)	(Lw=H)
Kh (cm/sec) =	2.07E-02	
Kh (m/sec) =	2.07E-04	
Kh (ft/min) =	4.07E-02	
Kh (ft/day) =	5.85E+01	

Elapsed Time (sec)	Residual Head (ft.)
0	0.599
0.25	0.52
0.5	0.33
0.75	0.39
1	0.35
1.25	0.32
1.5	0.40
1.75	0.31
2	0.30
2.252	0.27
2.5	0.30
2.75	0.26
3.11	0.22
3.47	0.24
3.89	0.19
4.31	0.18
4.73	0.17
5.21	0.13
5.75	0.16
6.23	0.13
6.83	0.10
7.43	0.09
8.03	0.07
8.69	0.08
9.41	0.05
10.19	0.03
10.97	0.05
11.81	0.05
12.71	0.05
13.67	0.06
14.63	0.03
15.71	0.05
16.85	0.02
18.05	0.02
19.31	0.02
20.63	0.04
22.07	0.01



APPENDIX E

Vadose Zone Hydraulic Conductivity Analyses

PROBLEM STATEMENT AND OBJECTIVE

Estimate the coefficient of permeability based on the in-situ falling head infiltration test(s) performed using methods from Schmid, ILRI, and Jarvis.

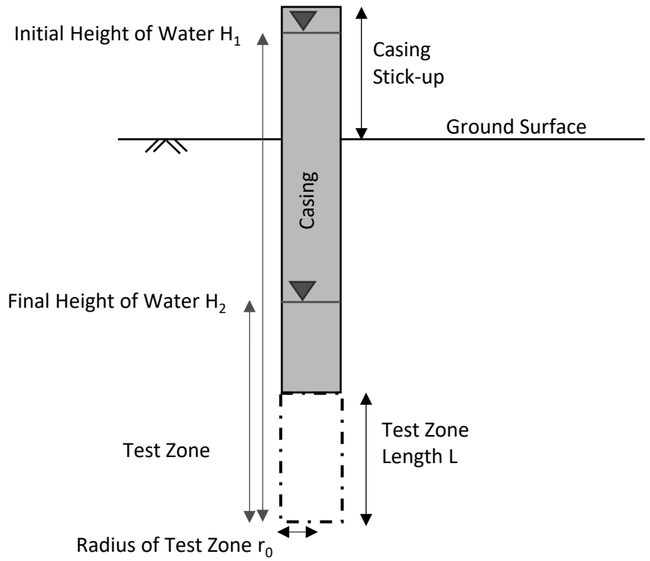
REFERENCES

1. American Society of Testing Materials (ASTM), "Field Determination of Permeability by the Infiltration Tests," Symposium on Permeability and Capillarity of Soils," by W.E. Schmid, 1967.
2. International Institute for Land Reclamation and Improvement (ILRI), Drainage Principles and Applications, 1980.
3. U.S. Department of the Interior, Water and Power Resources Service, Ground Water Manual, Revised Reprint 1981.

ASSUMPTIONS

1. The groundwater level is below the testing interval.
2. The initial and final height of water is measured from the bottom of the test zone.
3. Initial degree of saturation for Schmid method is 10%, final degree of saturation for Schmid method is 90%.
4. Porosity for Schmid method is 0.3.
5. Input depths reference depths from the ground surface.
6. If flush bottom technique was performed, input a small tezt zone length (L) for Jarvis method to compute.

SKETCH



PROCEDURE ***(TAKEN DIRECTLY FROM THE REFERENCES)***

Schmid Method

Let us assume that infiltration takes place from a cased hole whose bottom is a large distance above the ground water table.
We also assume that the wetting front has the shape of a spherical surface defined by the distance x measured from the intersection of the borehole axis and the plane through the bottom of the casing. We observe that the rate of progress of the wetting front is determined by the flow rate Q and the storage capacity of the soil per unit volume. The volume of the wetted soil mass with the wetting front at x will be $V_w = (4/3)\pi x^3$. The volume increment if the front advanced from x to x + Δx will be $\Delta V = (4/3)\pi[(x+\Delta x)^3 - x^3] = 4\pi x^2 \Delta x$ where higher order terms have been neglected. The water storage volume in this volume then will be $\Delta W = n(S_w - S_i)\Delta V = 4\pi n S x^2 \Delta x$.
Since this volume must correspond to the volume leaving the well, we may write, letting $\Delta x \rightarrow dx$, $r_0^2 \pi dh = -4\pi n S x^2 dx$
The solution of this differential equation is $h = -(4n/3r_0^2)Sx^3 + C$
Since we are interested in the rate of change of h, we may differentiate with respect to t and get $dh/dt = (4n/r_0^2)Sx^2 x = (4n/r_0^2)Sx^2(kl/nS) = (4/r_0^2)kdx$
$k = (r_0^2/4)\ln(h_1/h_2)/(x_2t_2 - x_1t_1)$
The equation still contains the variable x which will have to be found by an observation well.
$h_1 - h_2 = (4n/3r_0^2)S(x_2^3 - x_1^3)$
Assuming that initially $x_1 = r_0$, we get
$h_1 - h_2 = (4/3)Snr_0[(x_2^3/r_0^3) - 1] = (4/3)Snr_0[(x^2/r_0)^3 - 1]$ and $x_2 = r_0\,[3(h_1 - h_2)/4Snr_0 + 1]^{1/3}$

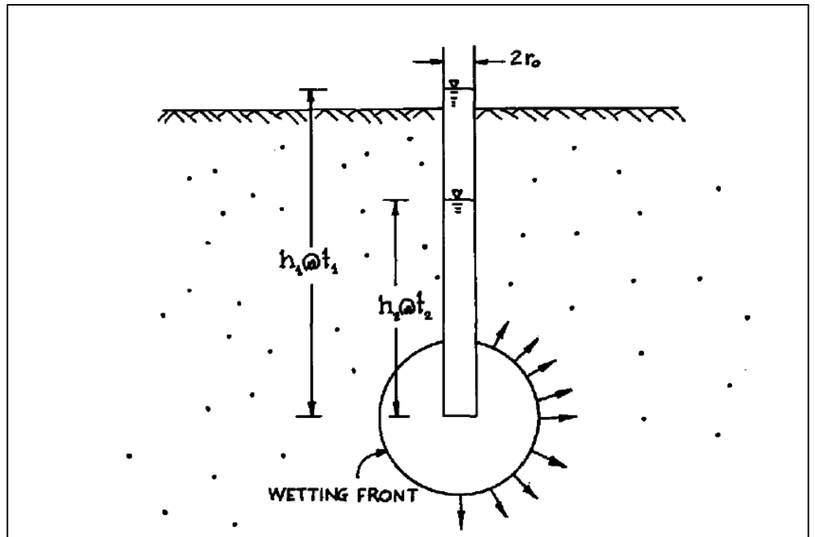
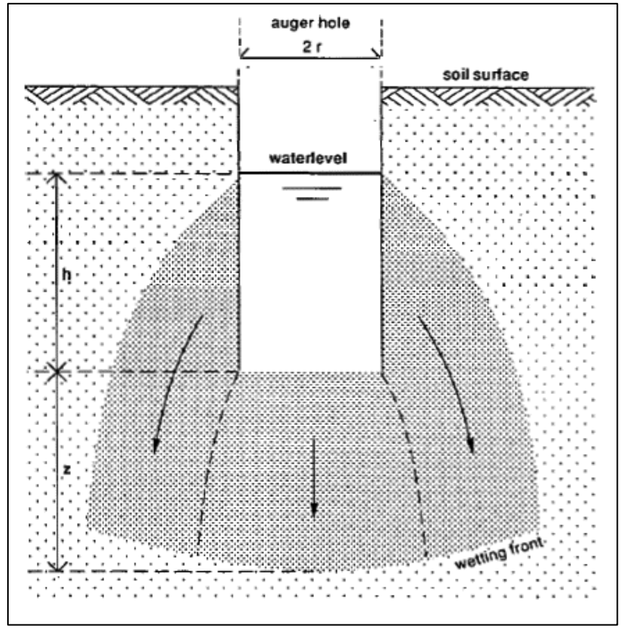
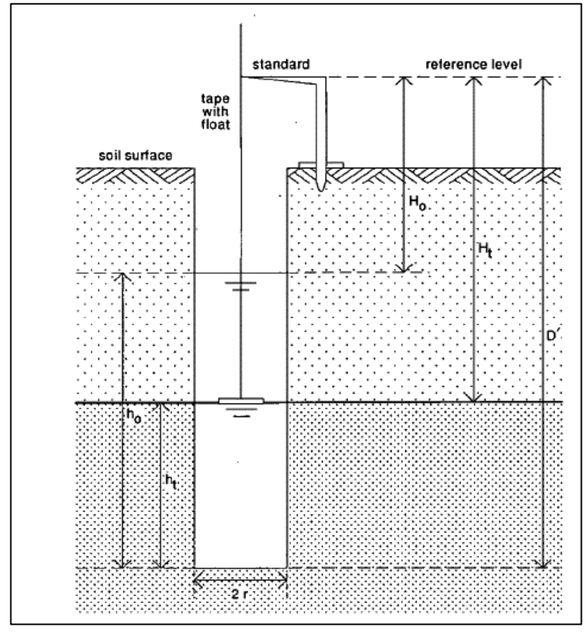


FIG. 3—*Cased well above ground water table falling head test.*

ILRI Method

If one uses a steel cylinder (also called "infiltrometer") to infiltrate water continuously into unsaturated soil, one will find after a certain time that the soil around and below the area becomes almost saturated and that the wetting front is a rather sharp boundary between wet and dry soil.
We shall consider a point just above the wetting front at a distance z below the soil surface in the area where the water infiltrates. The matric head of the soil at the point has a (small) value h_m. The head at the soil surface equals z + h (h=height of water level in the cylinder). The head different between the point at depth z and a point at the soil surface equals $z + h + |h_m|$, and the average hydraulic gradient between the two points is $s = (z + h + |h_m|) / z$
If z is large enough, s approximates unity. Hence, from Darcy's Law, we know that the mean flow velocity in the wetted soil below approaches the hydraulic conductivity (v=K) assuming the wetted soil is practically saturated.
The inversed auger-hole method is based on these principles. If one bores a hole into the soil and fills the hole with water until the soil below and around the hole is practically saturated, the infiltration rate v will become more or less constant. The total infiltration Q will then be equal to v x A (where A is the surface area of infiltration). With v = K, we get Q = k x A.
For the inversed auger-hole method, infiltration occurs both through the bottom and the side walls of the hole. Hence we have $A = \pi r^2 + 2\pi rh$ (where r is the radius of the hole and h is the height of the water column in the hole). So we can write $Q = 2\pi Kr\,(h+0.5r)$. Further, we can find Q from the rate at which the water level in the hole is lowered: $Q = -\pi r^2 dh/dt$. Eliminating Q in both expressions gives $2K(h+0.5r) = -r\,dh/dt$.
Upon integration and rearrangement, we obtain $K = 1.15r\,(\log(h_0+0.5r) - \log(h_t+0.5r)/(t-t_0)$
The values of ht are obtained from ht = D'-Ht where D' is the depth of the hole below reference level and Ht is the depth of the water level in the hole below the reference level. When H and t are measured at appropriate intervals K can be calculated. On semilog paper, plotting ht+0.5r on the log axis and t on the linear axis produces a straight line with a slope $\tan\alpha = \log(h_0+0.5r) - \log(h_t+0.5r)/(t-t_0)$.





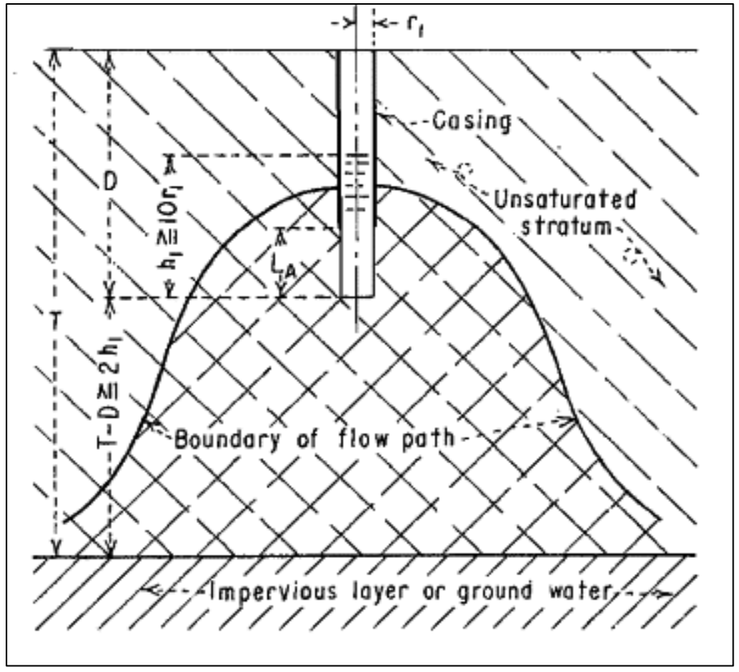
Client:	EnergySolutions			File No.:	127960-006
Computed by:	SHL	Checked by:	CJ	Date:	9-Jul-2020
		Sheet:	2 of 4	Project:	Fort Calhoun Station, Blair Nebraska
				Subject:	Falling Head Infiltration Permeability Test Data Reduction

PROCEDURE ***(TAKEN DIRECTLY FROM THE REFERENCES)***

Jarvis Method

Three-dimensional radial flow from a cylindrical well in an unsaturated isotropic pervious bed requires some special treatment. R.E. Glover has developed a precise solution for the steady-state flow from a well into an infinite unsaturated medium. This solution is based on flow from an array of point sources in a uniform stream. The relation between Q, h_1, r_1, and K was found to be $k = Q/(2\pi h_1^{\prime})[\sin^{-1}(h_1/r_1)-1]$ where h_1 = the depth of water in the test well.

All of the development given here have been applied to partially penetrating wells and to partly cased wells. Therefore, different limits of integration were applied to Glover's solution to yield the more general expression
$k = Q/(2\pi(2Ah_1-A_2)\ [\sin\text{-}1(L_A/r_1)-(L_A/h_1)]$



FORMULAS FROM REFERENCES

Schmid method

$$k = \frac{\left[\frac{r_0}{4}\ln\left(\frac{H_1}{H_2}\right)\right]}{T\left[\frac{3(H_1 - H_2)}{4Snr_0} + 1\right]^{0.33}}$$

from Equation 23 on page 151 of Reference #1.

k = hydraulic conductivity
r_0 = radius of test zone
T = total time of test
H_1 = initial height of water
H_2 = final height of water
S_i = initial degree of saturation
S_r = final degree of saturation
$S = S_r - S_i$

ILRI method

$$k = 1.15 r_0 \frac{\log(H_1 + \frac{1}{2}r_0) - \log\left(H_2 + \frac{1}{2}r_0\right)}{T}$$

from Section 12.6.2 "Inversed Auger-Hole Method" of Reference #2.

k = hydraulic conductivity
r_0 = radius of test zone
T = total time of test
H_1 = initial height of water
H_2 = final height of water

Jarvis method

$$k = \frac{r_0^2}{2LT}\left[\frac{\sinh^{-1}\frac{L}{r_0}}{2}\ln\left(\frac{2H_1 - L}{2H_2 - L}\right) - \ln\left(\frac{2H_1H_2 - LH_2}{2H_1H_2 - LH_1}\right)\right]$$

from Chapter 10 "Permeability Tests in Individual Drill Holes and Well" of Reference #3.

k = hydraulic conductivity
r_0 = radius of test zone
T = total time of test
L = length of test zone (input 0.01 ft if flush bottom technique was performed)

designates input cell

FIELD DATA AND CALCULATIONS

Boring No.	Test Date	Ground Surface Elevation	Casing Stick-Up (ft)	Depth to Top of Test Zone (ft)	Depth to Bottom of Test Zone (ft)	Top Elevation of Test Zone	Bottom Elevation of Test Zone	Length of Test Zone L (ft)	Length of Test Zone L (cm)	Radius of Test Zone r_0 (in)	Radius of Test Zone r_0 (cm)	Soil Strata of Test Zone	Initial Degree of Saturation S_i	Final Degree of Saturation S_r	Porosity n	Initial Height of Water H_1 (ft)	Initial Height of Water H_1 (cm)	Final Height of Water H_2 (ft)	Final Height of Water H_2 (cm)	Total Time of Test T (min)	Total Time of Test T (sec)	Schmid Coefficient of Permeability k (cm/sec)	ILRI Coefficient of Permeability k (cm/sec)	Jarvis Coefficient of Permeability k (cm/sec)
SB-08	na	0	1.1	3.9	5.0	-3.92	-5	1.08	32.9	1.9	4.8	m silt/sand, fairly d	0.1	0.9	0.3	4.98	151.8	4.1	125.0	40	2400	4.E-05	2.E-04	4.E-05
SB-11	na	0	1.2	3.8	5.0	-3.8333	-5	1.16666	35.6	1.9	4.8	nedium silt, dense	0.1	0.9	0.3	5.79	176.5	5.78	176.2	19	1140	2.E-06	4.E-06	7.E-07
SB-17	na	0	1.0	4.0	5.0	-4.0417	-5	0.95833	29.2	1.9	4.8	sand AND fine to m	0.1	0.9	0.3	5.15	157.0	5.06	154.2	19	1140	1.E-05	4.E-05	8.E-06
SB-25	na	0	1.0	4.0	5.0	-4	-5	1	30.5	1.9	4.8	sand AND fine silt	0.1	0.9	0.3	5.29	161.2	5	152.4	11.5	690	5.E-05	2.E-04	4.E-05
SB-32	na	0	1.0	4.0	5.0	-4	-5	1	30.5	1.9	4.8	o medium sand	0.1	0.9	0.2	5.81	177.1	4.68	142.6	9	540	1.E-04	9.E-04	2.E-04
SB-33	na	0	1.0	4.0	5.0	-4	-5	1	30.5	1.9	4.8	nedium silt, dense	0.1	0.9	0.3	6	182.9	5.94	181.1	9	540	2.E-05	4.E-05	9.E-06

Client:
Computed by: SHL Checked by: CJ
Sheet: 4 of 4

HALEY ALDRICH
File No.: 127960-006
Date: 9-Jul-2020
Project: Fort Calhoun Station, Blair Nebraska
Subject: Falling Head Infiltration Permeability Test Data Reduction

APPENDIX F

Zone of Influence Evaluation

FT. CALHOUN - ESTIMATED RADIUS OF INFLUENCE FOR RESIDENTIAL WELLS

OBJECTIVE

1. The purpose of this calculation is to estimate the radius of influence for residential pumping wells with varying pump rates and backfill materials.

REFERENCES

1. Driscoll Seepage Calculation based on the Sichardt Equation for radial seepage.
2. Environemtal Protection Agency (EPA) "Water Sense" website: https://www.epa.gov/watersense/how-we-use-water
3. Table 2.2 Range of Values of Hydraulic Conductivity and Permeability, Groundwater (1979), A. Freeze & J. Cherry.

ASSUMPTIONS

1. According to the EPA, the highest residential water usage is approximately 200 gallons per person per day.
2. For this analysis, we will assume an average household of 5 people. Therefore one household may use approximately 1000 gallons per day.
3. To provide conservative estimates with this calculation, we will assume that an average household may use up to 1628 gallons per day per household (2,250 m^3/year), to take irrigation and farming into account.
4. This equates to approximately 1.13 gallons per minute per household on average. For the purposes of this calculation, we will focus on the radius of influence for materials yielding 0.5 - 2 gallons per minute (gpm).
5. The following equations are used to calculate radius of influence:

$$Q = \frac{k(H^2 - h^2)}{1055 \log R / r_e}$$

$$h = \sqrt{H^2 - \frac{1055 Q \log R / r_e}{k}}$$

Where: **Q** = flow, gpm
k = hydraulic conductivity, gpd/sq.ft.
H = saturated thickness before pumping, ft.
h = saturated thickness after pumping, ft.
R = radius of influence, ft. (based on Siechardt equation).
r_e = effective well radius.
r = radius within the cone of depression, ft.

6. The following information is given:
   Range of hydraulic conductivity (k) from $1x10^{-2}$ to $1x10^{-6}$ cm/sec.
   Aquifer thickness (H) of 30 feet.
   Effective porosity of 0.3.
7. Calculations will be completed iteratively using a saturated thickness from 0 - 30 ft and a range of k values as stated above.
8. The material types associated with each hydraulic conductivity value in these calculations are generalized estimates based on Table 2.2 from Groundwater (1979) by Freeze & Cherry. Actual k values may vary depending on the specific composition of the material used.

CALCULATIONS

1. Radius of Influence with pumping rate range of approximately 0 - 2 GPM (0 - 3,979 m^3/year), Clean Sand (K = $1x10^{-2}$ cm/sec).

Material K (cm/sec)	Q (gpm)	k (gpd/ft.^{2})	H (ft.)	h (ft.)	R (ft.)	r_e (ft.)	s (ft.)	Excavation Length (ft.)	Excavation Width (ft.)
1E-02	#DIV/0!	2E+02	30	30	0.6	0.56	0	1	1
1E-02	1.5	2E+02	30	29.9	3.6	0.56	0.1	1	1
1E-02	2.3	2E+02	30	29.8	6.6	0.56	0.2	1	1
1E-02	2.9	2E+02	30	29.7	9.6	0.56	0.3	1	1

2. Radius of Influence with pumping rate range of approximately 0 - 2 GPM (0 - 3,979 m^3/year), Silty Sand (K = $1x10^{-3}$ cm/sec).

Material K (cm/sec)	Q (gpm)	k (gpd/ft.^{2})	H (ft.)	h (ft.)	R (ft.)	r_e (ft.)	s (ft.)	Excavation Length (ft.)	Excavation Width (ft.)
1E-03	#DIV/0!	2E+01	30	30	0.6	0.56	0	1	1
1E-03	1.1	2E+01	30	28	60.6	0.56	2	1	1
1E-03	1.9	2E+01	30	26	120.6	0.56	4	1	1
1E-03	2.6	2E+01	30	24	180.6	0.56	6	1	1

CALCULATIONS (CONT.)

3. Radius of Influence with pumping rate range of approximately 0 - 2 GPM (0 - 3,979 m^3/year), Silty Sand to Silt (K = $1x10^{-4}$ cm/sec).

Material K (cm/sec)	Q (gpm)	k (gpd/ft.^{2})	H (ft.)	h (ft.)	R (ft.)	r_e (ft.)	s (ft.)	Excavation Length (ft.)	Excavation Width (ft.)
1E-04	#DIV/0!	2E+00	30	30	0.6	0.56	0	1	1
1E-04	0.4	2E+00	30	20	300.6	0.56	10	1	1
1E-04	0.5	2E+00	30	10	600.6	0.56	20	1	1
1E-04	0.6	2E+00	30	0	900.6	0.56	30	1	1

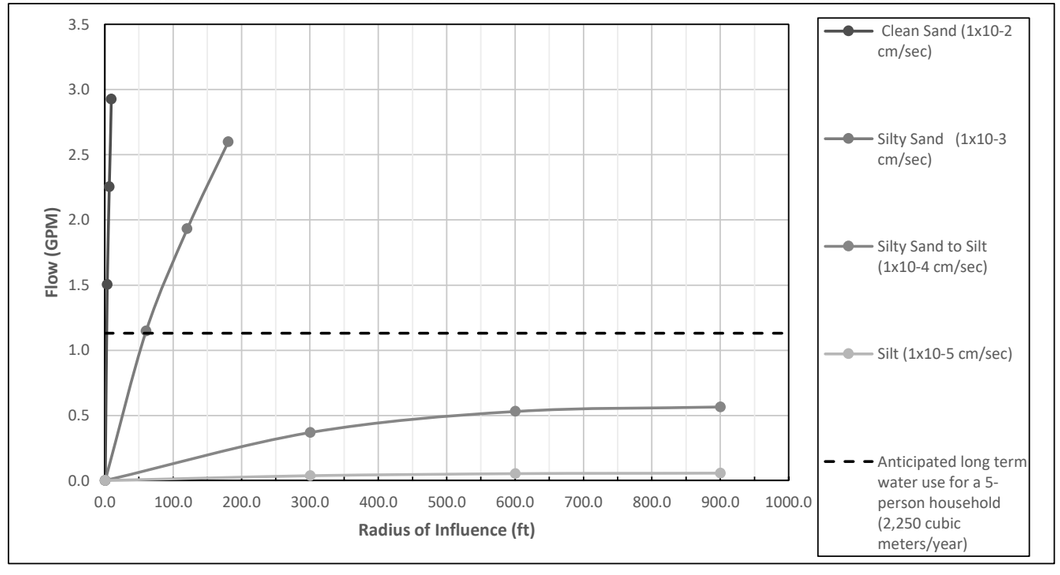
4. Radius of Influence with pumping rate range of approximately 0 - 2 GPM (0 - 3,979 m^3/year), Silt (K = $1x10^{-5}$ cm/sec).

Material K (cm/sec)	Q (gpm)	k (gpd/ft.^{2})	H (ft.)	h (ft.)	R (ft.)	r_e (ft.)	s (ft.)	Excavation Length (ft.)	Excavation Width (ft.)
1E-05	#DIV/0!	2E-01	30	30	0.6	0.56	0	1	1
1E-05	0.0	2E-01	30	20	300.6	0.56	10	1	1
1E-05	0.1	2E-01	30	10	600.6	0.56	20	1	1
1E-05	0.1	2E-01	30	0	900.6	0.56	30	1	1

5. Radius of Influence with pumping rate range of approximately 0 - 2 GPM (0 - 3,979 m^3/year), Silt to Glacial Till (K = $1x10^{-6}$ cm/sec).

Material K (cm/sec)	Q (gpm)	k (gpd/ft.^{2})	H (ft.)	h (ft.)	R (ft.)	r_e (ft.)	s (ft.)	Excavation Length (ft.)	Excavation Width (ft.)
1E-06	#DIV/0!	2E-02	30	30	0.6	0.56	0	1	1
1E-06	0.0	2E-02	30	20	300.6	0.56	10	1	1
1E-06	0.0	2E-02	30	10	600.6	0.56	20	1	1
1E-06	0.0	2E-02	30	0	900.6	0.56	30	1	1

SUMMARY OF RESULTS - ESTIMATED RADIUS OF INFLUENCE WITH VARIABLE PUMP RATE AND HYDRAULIC CONDUCTIVITY



NOTE: As shown in the calculations above, materials with a hydraulic conductivity of $1x10^{-4}$ cm/sec or less cannot produce enough flow with the available saturated thickness.